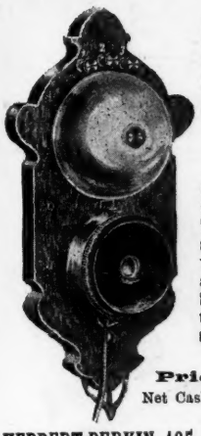
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXIV. No. 1898.] LONDON, SEPTEMBER 26, 1899. [51ST YEAR. PRICE 6d.

STENTOR TELEPHONES.



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Complete Installation—comprising Two Telephone Instruments, complete with Call Bell, Push, and Automatic Switch, Two Batteries, 330 Feet Insulated Wire, Staples, and Instructions.

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HEBBURN MAIN GAS COALS.

Yield of Gas per Ton . . 10,500 Cubic Feet.
Illuminating Power . . . 16·4 Candles.
Coke . . . . . 68 per Cent.

For Prices, f.o.b. Ship or Delivered by Rail, apply to

The Wallsend & Hebburn Coal Company, Ltd.
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W. RICHARDSON, Fitter.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.

Above the Average in Weight and Quality of Coke.

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Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores, for Gas and Water Works.

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Wrought-Iron
TUBES
And Fittings and Accessories.

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MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM,
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
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BIGGS, WALL, & CO.,
GAS AND WATER ENGINEERS,
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LONDON, E.C.

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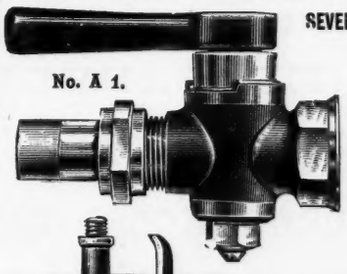
FULL-WAY MAIN TAPS & LANTERN TAPS.

SEVERAL DESIGNS SHOWN BELOW.

No. A.

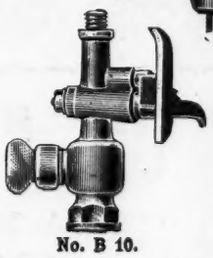
THESE TAPS ARE
FULL-WAY
AS SHOWN.

No. A 1.



SUPERIOR QUALITY AND FINISH IN GUN METAL.

LANTERN TAPS.



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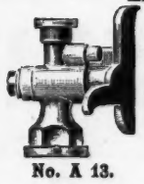

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No. A 12.

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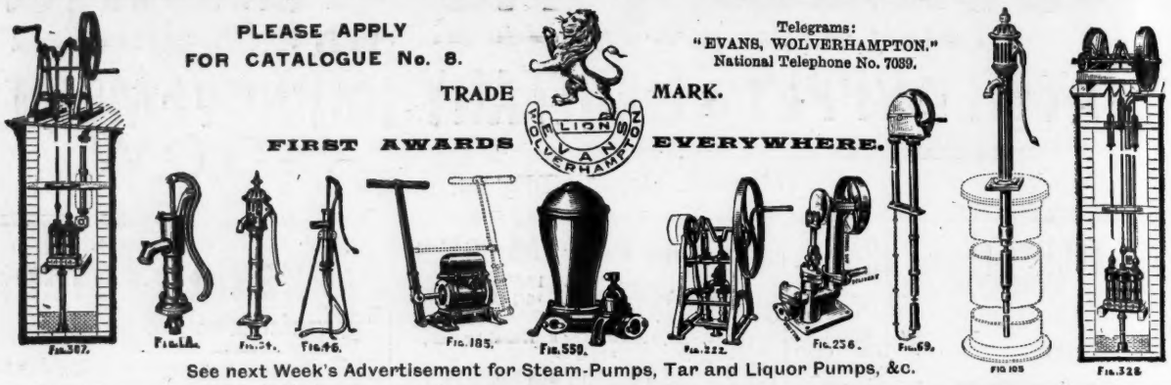

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OIL FOR GAS MAKING

PURE DISTILLATE.

HOMOGENEOUS IN CHARACTER.

NO MIXTURE.

CAN BE STORED SAFELY ANYWHERE.

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(ABEL'S CLOSED TEST.)

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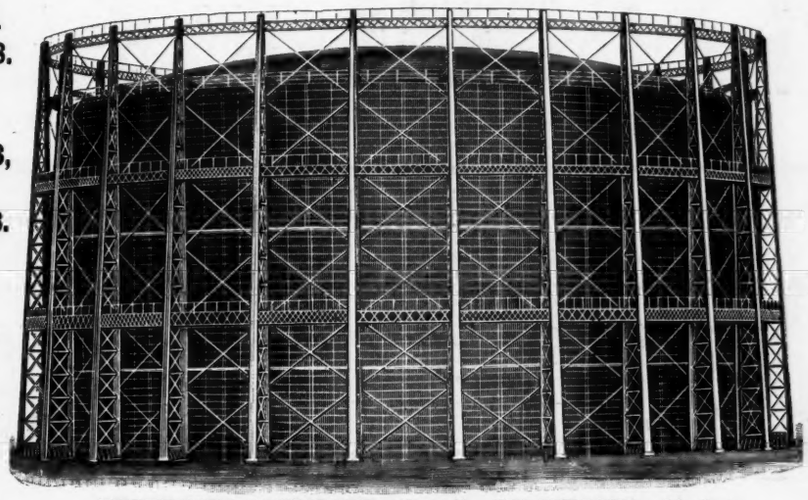

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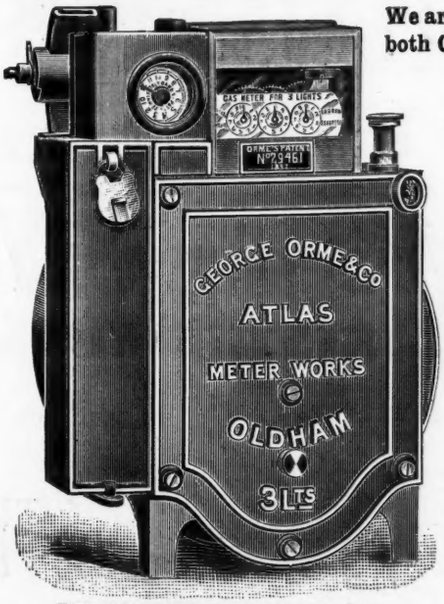


WET COIN METER IN CAST-IRON CASE.

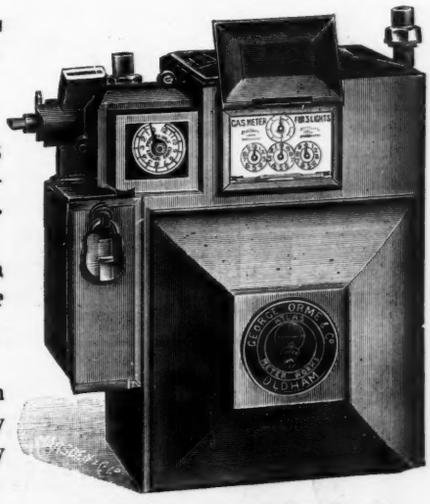
We are now supplying our Wet Coin Meters in Cast-Iron and Tin-Plate Cases, both Ordinary and Compensating; also Dry Coin Meters in Tin-Plate Cases.

A large number of these Meters are in use, and giving satisfaction.

The Mechanism is very simple; and there are no springs or complicated parts to get out of order.

We supply them to work with **1d., 1s., or any other Coin desired.**

The Selling Price of Gas can be changed *in Situ*, and any number of feet delivered, as may be required.



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Manufacturers of every description of

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Improved COAL and COKE HANDLING PLANT, CONVEYORS, and ELEVATORS,

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PURIFIERS with Planed Joints a Speciality.

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DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

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Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

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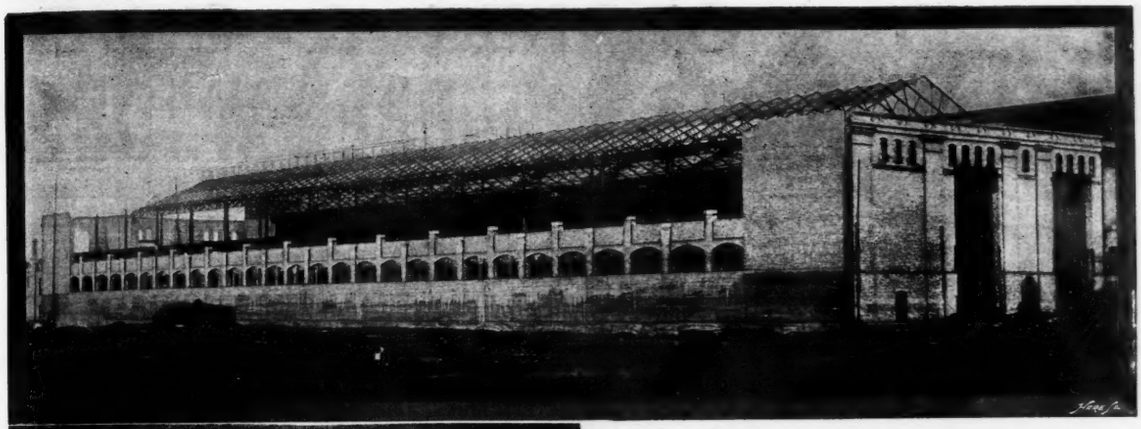

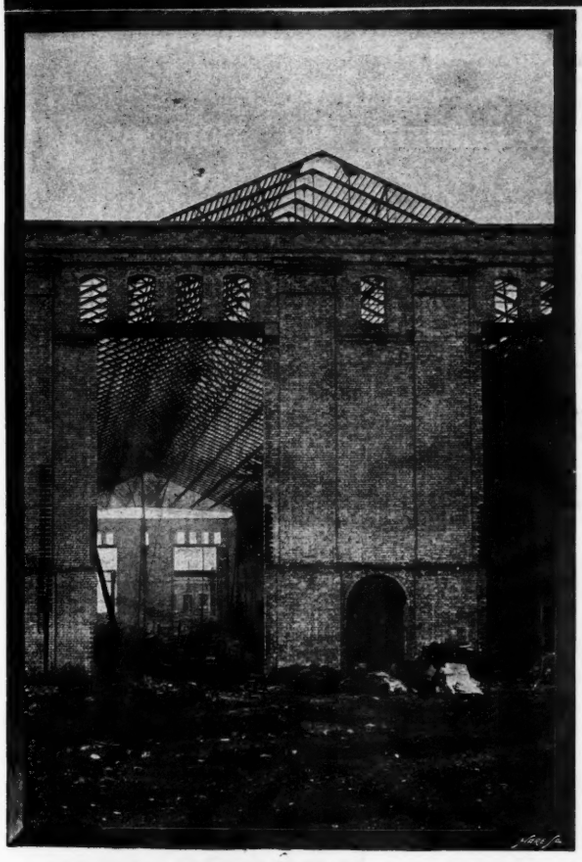

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MANUFACTURERS OF GASHOLDERS PURIFIERS AND EVERY DESCRIPTION OF GAS PLANT OF ANY CAPACITY.

Station Meters, Wet and Dry Consumers' Meters, Prepayment Meters, Gas Apparatus, and Gas Fittings.

Also Bridges, Roofs, Columns, Girders, and Structural Iron and Steel Work of all kinds.

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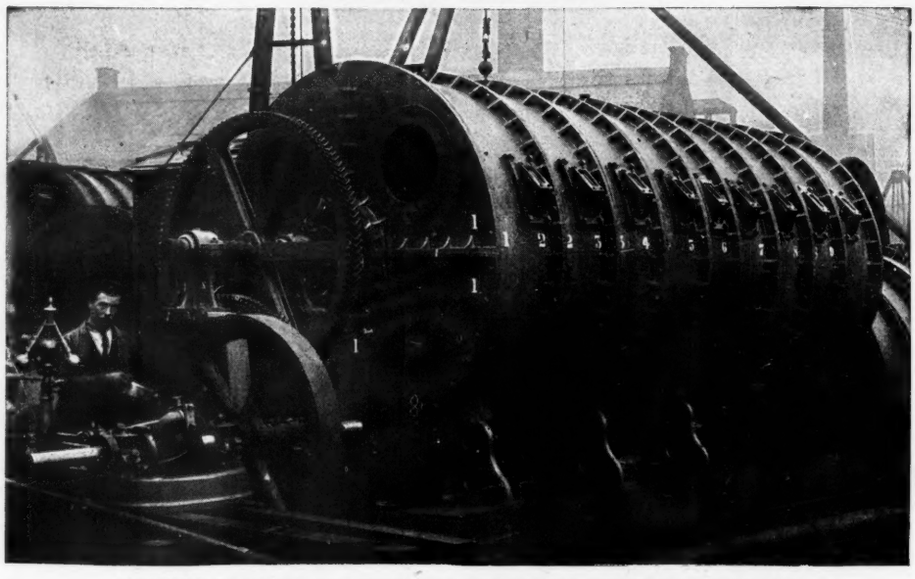
HORIZONTAL TYPE.

Machines of this and Vertical Type erected last year and now on order, equal to £6,270,000 cubic feet per diem.

Results guaranteed.



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LARGEST MANUFACTURERS IN THE UNITED KINGDOM OF GAS-RETORTS,

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"SPECIAL" GAS-BURNERS.

SUITABLE FOR ALL PRESSURES AND CONDITIONS.

GEO. BRAY & CO.

GAS LIGHTING ENGINEERS,

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WORKMANSHIP and MATERIALS OF THE HIGHEST QUALITY.

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Built to any Specification or Gauge.

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IN COURSE OF ERECTION BY OUR OWN WORKMEN.

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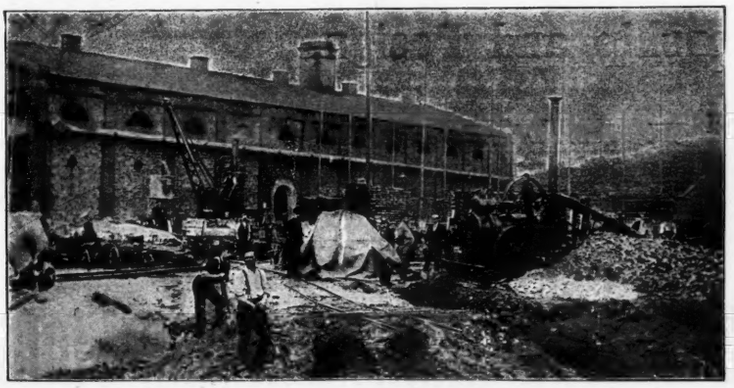
Special Facilities for RECONSTRUCTING GAS-WORKS.

CONDENSERS, SCRUBBERS, WASHERS, EXHAUSTERS, TANKS, and every REQUISITE.



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INCLINED and FLOOR-LEVEL SETTINGS with or without REGENERATIVE or GENERATOR FURNACES, with or without IRONWORK. COMPLETE RE-SETTING.

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WELSBACH INCANDESCENT GAS-LIGHT.

INCANDESCENT STREET LIGHTING.

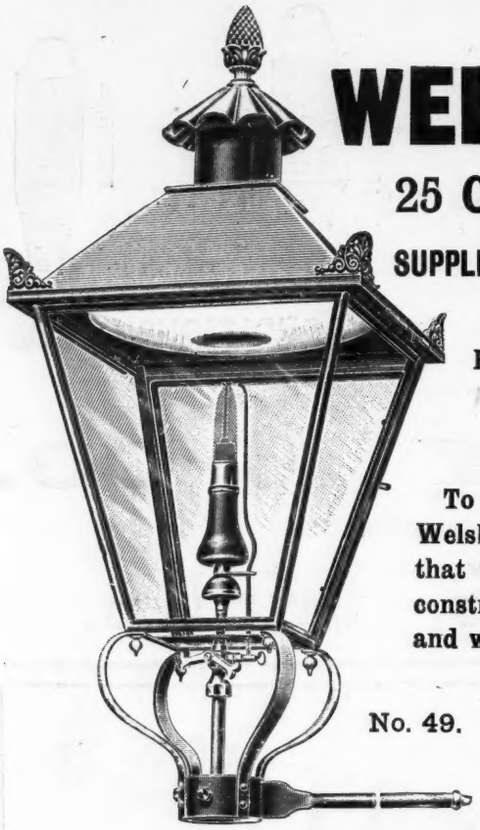
NEW WELSBACH BURNERS

25 Candles per Cubic Foot of Gas.

SUPPLIED IN SIX SIZES, CONSUMING FROM ¾ TO 7 CUBIC FEET OF GAS PER HOUR.

For Street Lighting the sizes recommended are—

Nos. 2, 3, and 4.



No. 49.

To ensure success with the New Welsbach Burners, it is essential that they should be fitted in well constructed and thoroughly rain and wind proof lanterns.

No. 45.

THE GAS LANTERNS MANUFACTURED BY THE WELSBACH INCANDESCENT GAS-LIGHT COMPANY, Ltd., are of the best Workmanship and Design.

THE WELSBACH ANTI-VIBRATION ATTACHMENT enables the new Welsbach Burner to be used with the greatest economy in renewal Mantles for Street Lighting, or otherwise, notwithstanding the severest vibration.

PRICE LIST ON APPLICATION.

The Welsbach Incandescent Gas-Light Co., Ltd.,

YORK STREET & PALMER STREET, WESTMINSTER, LONDON, S.W.

S. Cutler & Sons,
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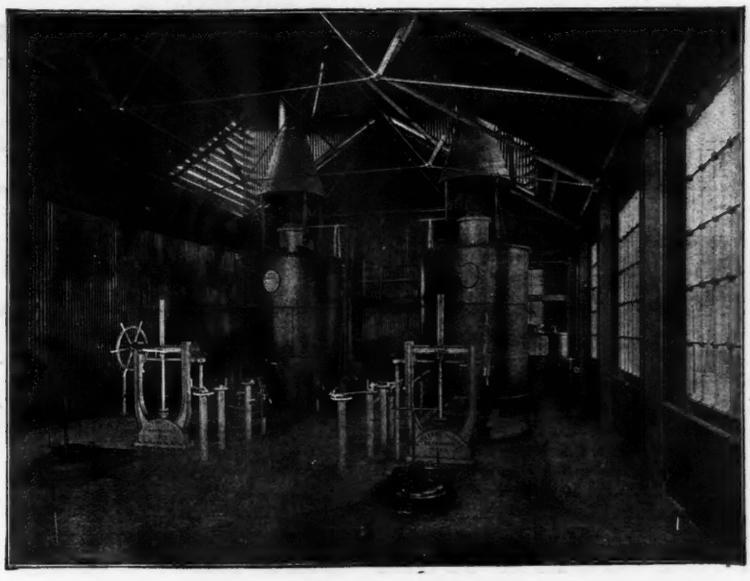
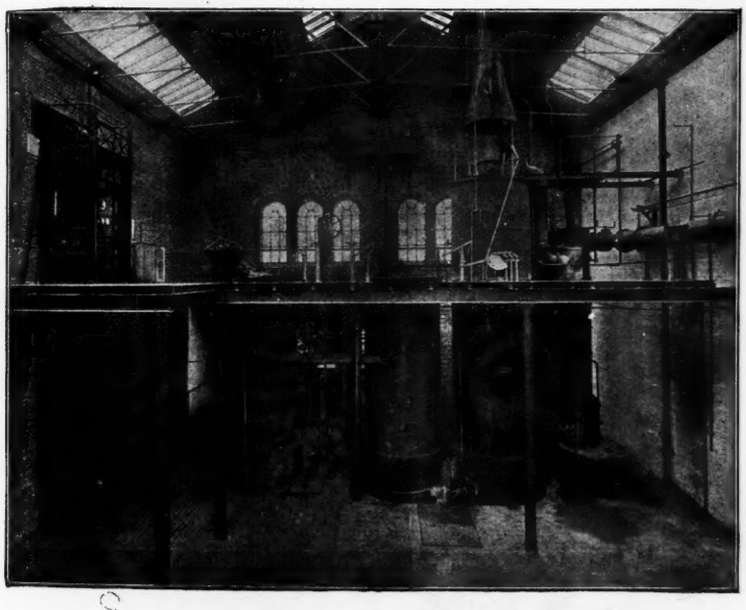
GASHOLDERS.

CARBURETTED WATER-GAS PLANT.



Water-Gas Plant at Southall.



Water-Gas Plant at Folkestone.

Carburetted Water-Gas Installations.

HORNSEY.
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HORSHAM.
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SOUTHEND (2nd Order).
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ADOPTED FOR
MANY IMPORTANT
GASHOLDERS.

OIL-TANKS.

EVERY DESCRIPTION OF
GAS-WORKS APPARATUS.

Water-Gas Plant at Southend.

WEST'S GAS IMPROVEMENT CO., LTD.

Gas and General Engineers,

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER,
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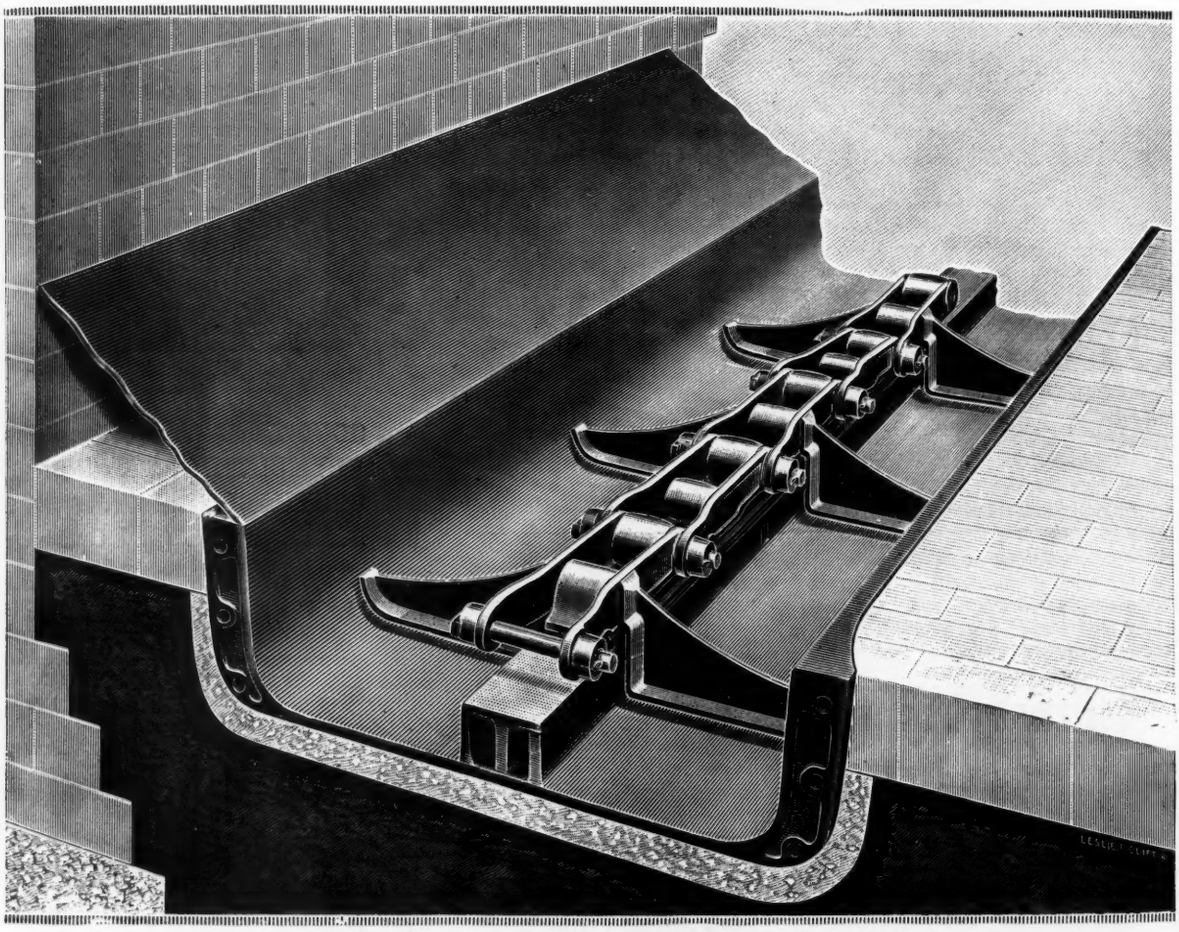
For Conveying, Elevating, Storing, and Stacking

HOT COKE from GAS-RETORTS and COKE-OVENS.

These Conveyors are fitted with Hunt's Patent Anti-Friction Roller Chain, which is especially adapted for this purpose.



SPECIAL FEATURES.

Simplicity in Design, and does not damage the Coke.
Silent in action.
The Roller Chain ensures long life to the Chains and Chain Wheels.

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"ACME" GAS-STOVE WORKS, ASTON, BIRMINGHAM.

"CERBERUS" CONDENSING STOVE, No. 1094.

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Engraved from a Photograph taken during Construction of our Shallow Regenerator Settings

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OF EVERY DESCRIPTION:

INCLINED, HORIZONTAL,

REGENERATOR, GENERATOR,

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SHALLOW REGENERATORS A SPECIALITY

MANY INSTALLATIONS.

EXCELLENT RESULTS OBTAINED.

RETORTS RE-SET.

RETORT IRONWORK.

COAL AND COKE-BREAKING AND CONVEYING MACHINERY.

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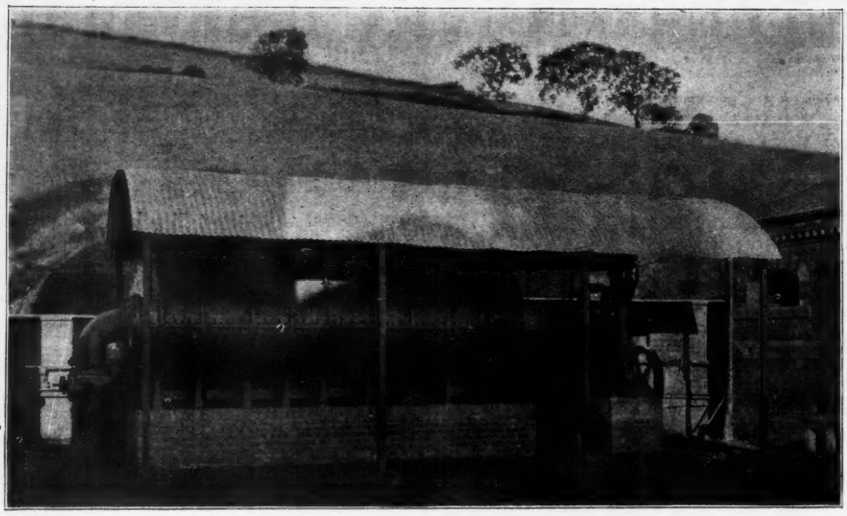
KIRKHAM, HULETT, & CHANDLER, LTD.,
PATENT "STANDARD" WASHER-SCRUBBER

Extracts ALL the Ammonia and a large proportion of the Sulphuretted Hydrogen and Carbonic Acid.



Old Pattern Machines fitted with latest Improvements at small cost.

Inspection and Estimates on Application.

PATENT "STANDARD" WASHER-SCRUBBERS in use and in hand now number over

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ANGLO-AMERICAN OIL COMPANY, LIMITED

This well-known quality of Oil is used at most of the Corporation Works and Companies' Works throughout the United Kingdom. Contracts have also been entered into with several of the large Railway Companies.

LARGE STOCKS. PROMPT DELIVERY.

Stock of about 30,000 Tons is usually carried by us at our Installations at Avonmouth, Birkenhead, Barrow, Manchester, and London.

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CARBURETTED WATER-GAS PLANT

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Copenhagen (Second Contract)	2,500,000	Commercial (Second Contract)	850,000
Belfast	1,700,000	Commercial (Third Contract)	1,250,000
Belfast (Second Contract)	4,500,000	Croydon	1,250,000
Brussels	700,000	L. & N.W. Railway, Crewe	700,000
Brussels (Second Contract)	700,000	Taunton	225,000
Liverpool	3,500,000	Lawrence, Mass.	400,000
Liverpool (Second Contract)	4,500,000	Rotterdam	850,000
Tottenham	750,000	Dorking	125,000
Tottenham (Second Contract)	750,000	McKeesport, Pa.	500,000
Santiago de Cuba	400,000	The Gaslight and Coke Co., Bromley	3,750,000
Swansea	750,000	The Gaslight and Coke Co., Nine Elms	2,750,000
Manchester	3,000,000	Durham	200,000
Brighton	1,750,000	New York (Remodelled)	11,000,000
Preston	1,500,000	Scarborough	800,000
New York	1,200,000	Perth, W.A.	125,000
Southport	750,000	Bremen	550,000
Bath	1,000,000	Maidenhead	225,000
Newburgh, N.Y.	350,000	Epsom	225,000
Newburgh, N.Y. (Second Contract)	250,000	North Middlesex	150,000
Hoylake	125,000	Wandsworth and Putney	1,800,000
Coventry	600,000	Aarhus	800,000
Coventry (Second Contract)	600,000	Falmouth	150,000
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Holyoke, Mass.	600,000	Bournemouth	1,000,000
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Lea Bridge (Second Contract)	350,000	Hamburg	1,750,000
Stockton-on-Tees	500,000	Dublin	2,000,000
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Edinburgh	2,000,000	Stockport (Second Contract)	500,000
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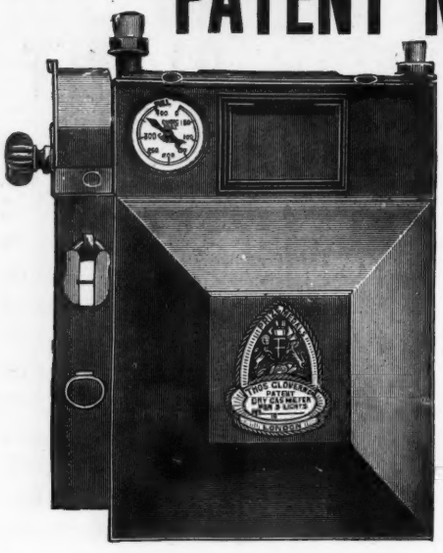

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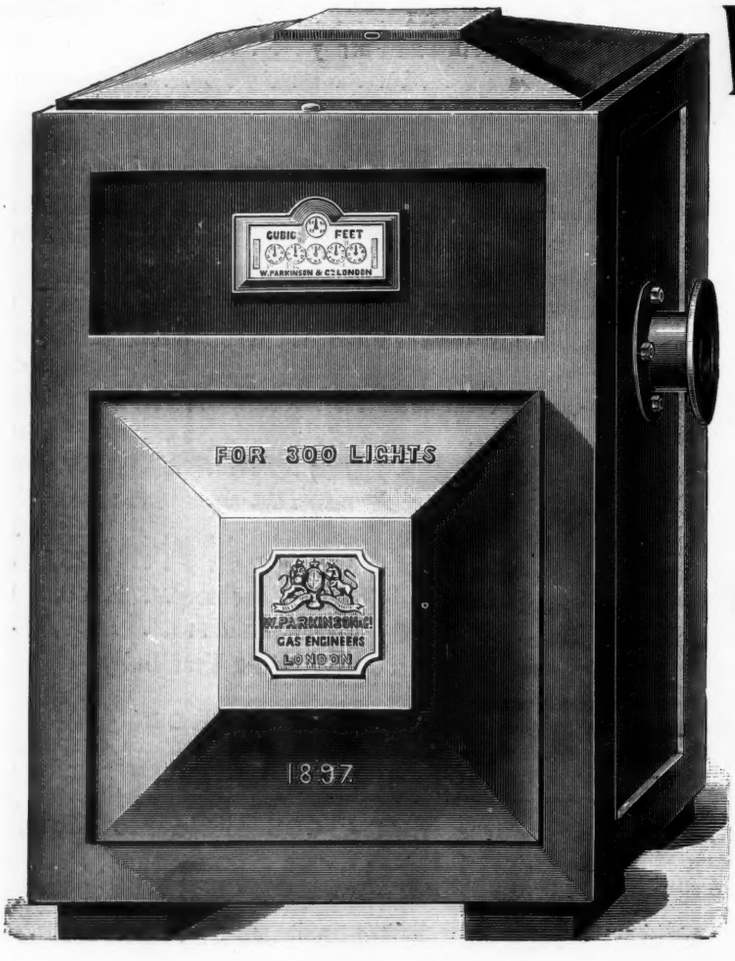

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

Tightening Up the South Metropolitan Profit-Sharing Scheme.

IT is not very creditable to human nature that anything which looks like failure of a well-meant endeavour to improve the lot of any section of the community should be hailed, as it usually is, with undisguised glee by some newspapers and individuals. Yet this is the common experience of would-be benefactors of their fellows who venture to try to do good while others only talk about it. Nobody can put out a hand to lift a fellow-creature out of the rut in which conventional civilization has placed him, without being sneered at for his pains; and if the individual who is helped fails to justify the particular method employed for his assistance, there is invariably a chorus of "I told you so!" on all sides. Of course, should the captious looker-on be interested in another "cause," his outcry is all the louder. These general reflections are suggested by the announcement that the Directors of the South Metropolitan Gas Company have decided to revise that part of the profit-sharing scheme of the Company which is concerned with the permanent investment, or "putting by," of the withdrawable bonus. We publish in another column the terms of the circular which the Board have felt it their duty to issue to the participants in the scheme. It should be read carefully, in view of the distorted and highly-coloured representations of what has been done, which some Trade-Union-favouring newspapers have thought fit to circulate. Misrepresentation, as we are all aware, is one of the ordinary weapons of political controversy; but it is a pity when the rotten eggs of party contests are borrowed for use in elucidating industrial questions. The "Daily Chronicle," and some of its congeners in different parts of the country, have gladly trumpeted forth the tidings that Mr. George Livesey's circular confesses the failure of his scheme of profit-sharing. The wish is the father of that thought. How much truth there is in this interpretation of the situation may be estimated on reference to the circular itself, read in the light of Mr. Livesey's speech at the last general meeting of the Company. The people who fall foul of Mr. Livesey, for political reasons, are beyond the reach of argument. Others, who may be disposed to think that there is something in the view that the circular under notice is a confession of at least the partial failure of the system, may be reminded that profit-sharing is no panacea for the shortcomings of workmen. It is not another name for slavery, like Trade Unionism; and it appeals to some of the better, instead of the worst, motives of men who have to work for their living. It is one thing, however, to lead a horse to the water, and another to make him drink. The mainspring of all possible profit-sharing schemes is the reasonable presumption that workmen will respond to the offer made to them. Sometimes they do, sometimes they do not. More than one promising scheme of the kind has fallen through for the latter reason; but this is nothing to gloat over. It is recognized as one of the inherent weaknesses of the idea of profit-sharing, that the idlers and wasters share with the assiduous and saving in the benefits earned solely by the latter. Nobody has yet been able to remedy this defect, which is certainly not singular with the South Metropolitan men. What is peculiar to this scheme, however, is the use now made of the habitual withdrawal of bonuses as an indication that those men who practise it do not appreciate the benefit conferred upon them.

This, it must be confessed, is a debateable point. The investment or saving of the man's share of the profits he earns is not an essential part of profit-sharing. Not to labour the point, it must be conceded that the direction of what he shall do with his bonuses is a feature of the South Metropolitan scheme which a workman or officer may resist, upon principle. At the same time, the Board, in taking the order they have in this regard, probably know what they are about, and are well advised in choosing this way of sifting out the unworthy participants—which, as we have remarked with regard to the same discipline, is not an easy thing to do. Injustice may be wrought by doing anything to this intent, or nothing. To argue that the profit-sharing scheme of the South Metropolitan Company has failed because about one-half of the employees of the Company have not benefited by it in the precise way that the Board

desire to see, is a straining of the logic which it will not bear. Besides, it is a misstatement to say, as the "Daily "Chronicle" does, that this disappointment of the Directors is something new, traceable to the novelty of the scheme having "worn off." The words of the circular are explicit on this head. It states that "the average of "all the stations is 3 per cent. better than last year, which "is evidence that we are advancing slowly." The complaint is, not that the withdrawals of bonuses are a new feature, but that "for ten years this has been going on." The new circular, in short, is designed to cauterize an old sore, not to heal a fresh wound. It is of the first importance that this truth should be perceived. When the scheme was originated, although the Directors hoped the men would leave their money in the concern, and so become permanently interested in its welfare, they intentionally left it open for the profit-sharers to withdraw part of their money, if they chose, in order to convince them that it was really their very own. Many men did this, for the satisfaction of handling the cash; afterwards paying it back. But, rightly or wrongly, the Board have now decided that the fact of habitual withdrawal is evidence that the men who so act take little or no interest in their own permanent welfare, and are therefore not likely to be of much good to the Company. We should misjudge them if we did not believe that the Directors will interpret this general rule with all mercifulness to individuals. Even so, the saving of a week's wages during the year will be taken as evidence that a man is not an unworthy subject of the Board's solicitude. Mr. Livesey's personal solicitude for the preservation of the "nest egg" is due to the very natural and intelligible desire that there may be something tangible and attractive to bind the employees of the Company together and to the undertaking after he shall have passed away.

Herr von Oechelhaeuser on the Gas Industry.

The German Association of Gas and Water Engineers met at Cassel this year, under the presidency of Herr von Oechelhaeuser; and we have much pleasure in commending to our readers' attention the epitomized translation of the President's Inaugural Address which is given in another column. Perhaps the most noteworthy thing in regard to this address is its manifestation of the spirit of eagerness to recognize and turn to account the very latest gains of applied science. This is the inspiration of modern industrial Germany; and it is more than gratifying—it is positively exhilarating—to find it so abundantly evident in the utterances of Herr von Oechelhaeuser. It may not be out of place here to explain that he is the typical German gas maker, representing not merely the technical and scientific side of the industry, but also its finance; so that all he says of the industry is hard, matter-of-fact business. He has to make dividends as well as gas, and thus never loses sight of the "thing that pays" when discussing technics. He knows that science, bridled with common-sense, pays. He knows that liberal, but judicious, capital outlay on the business pays; and, like the majority of his countrymen of the present generation, he is absolutely destitute of prejudice and preconceived notions. Individually, moreover, Herr von Oechelhaeuser is candour itself. He plays the game thoroughly, with his cards on the table; and what he thinks worthy of his own and his brother technicians' cogitation, he tells without reserve. It is therefore well to know what such a man is thinking about in connection with the European gas industry; and this his address discloses.

In the first place, the President has a watchful eye on the proceedings of his rivals in the business of artificial lighting. Accordingly, he desired in his official capacity to secure a lecture from Professor Nernst himself on the last new incandescent lamp. Unfortunately, the wish was disappointed; but, meanwhile, the President has his own opinion of the Nernst light, which he does not hesitate to express. It is, in his judgment, merely an economical device. In no other respect does it challenge other means of lighting. It is not more beautiful, more convenient, more healthful, or indeed anything else than capable of reducing the consumption of current by one-half, as compared with the older kind of electric incandescent lamp. Thus all those æsthetic and sanitary pretensions of the older lamps put forward at the time of their introduction, and so impossible of valuation, can be left out of account in appraising the Nernst lamp. The gas industry need not be afraid to meet the new competitor upon its own ground. The other new illuminant—acetylene—has its market, which is not that served by the gas industry in the ordinary way. Carburetted water gas is admitted to be now a permanent addition to the resources of the gas maker; but in Germany, for fiscal reasons, the carburetting material must be benzol, not petroleum.

This line of reasoning leads the President to the question, fast rising into practical importance, of the validity of the old criterion of value of illuminating gas. Why maintain an obsolete standard of quality for the manufacture, when the conditions of utilization of the product are completely altered? The old system was really against the user, because in the ordinary way the gas consumer could never obtain the results procured in the photometer-room. Now "the boot is on the other leg." The consumer can get a light of 65-candle power from gas which, in the photometer, used in the legal way, only shows 14, 10, or 8 candle power. Nay—the experiments of the German Continental Gas Company go to prove that, when the nominal illuminating power of Dessau gas was reduced from 13 to 2 candles in the flat-flame burner, the light of the incandescent gas-burner actually rose from 66·5 to 73·5 candles. Herr von Oechelhaeuser asks for experimental confirmation of these results. Perhaps Dr. Clowes will "oblige," for the information of the London County Council. Edinburgh, Liverpool, Birmingham, and Leicester may be confidently expected to do so. With the national promptness in recognizing facts, the Local Authority of Magdeburg have already accepted the practical deduction from similar data, and are content with 7-candle gas.

Germany—if not the native land, at least the nursing mother of the incandescent gas-burner—has brought the system up out of the leading-strings of the Patent Law. With good mantles at 3d., and very superior ones at 6d. apiece, and absolute free trade in burners and attachments, the system has attained an assured position. As with all other inventions susceptible of development, by successive steps and in consecutive degrees German incandescent gas lighting has so improved that the duty of common burners determined by Herr von Oechelhaeuser himself seven years ago, and adopted by the Prussian Government, has been doubled. It is now, on the same authority, to be taken at from 0·04 to 0·06 cubic foot of gas per candle power; and this with burners consuming 3 cubic feet of gas per hour, at a pressure of 10-10ths of an inch of water. The competition which the electric lighting interest has now to face, by its Nernst lamps or otherwise, is with gas-lighting units of from 66 to 88 candle power. This circumstance is sufficiently serious for the standard 8-candle lamps of English electric lighting companies. In this connection, it may not be superfluous to repeat that the advanced Municipalities of Berlin and other German cities have abandoned electric lighting, arc and incandescent, for the public lamps, and have definitely adopted incandescent gas-light in its stead—until something even better shall appear. For which eventuality the gas industry can afford to wait, but not supinely. Herr Oechelhaeuser concludes his inspiriting and informing address by registering the cheering fact that the number of new gas-works in course of construction in Germany this year is greater than was ever before known. After this, our friends the electricians will have to alter their hackneyed chorus about this "moribund industry."

The Eastern Counties Meeting—Another Plea for Unity; the Water-Gas Report.

For the second time in their history, the members of the Eastern Counties Gas Managers' Association have met at Sleaford—the home of their new President, Mr. Harry Wimhurst, whose work for the Association as one of the founders and for so many years as Honorary Secretary entitled him to the highest honour the members could confer. The wonder is that they did not crown their oft-repeated appreciation of his labours by dignifying him in this manner at an earlier date. But really nothing has been lost by delay; for, judging by the ovation which greeted him on ascending to the chair last Wednesday, the sentiment which he evoked towards himself in the hearts of the gas fraternity of the Eastern Counties in the days of his official connection with the Association is as warm as ever it was. As was quite fit and proper, the meeting inaugurating his year of office was one which will stand out well among the worthiest of the Association's previous

gatherings. The presidential address was very modestly worded; but it bore the marks of care and investigation in preparation. Within brief compass, it touched on many subjects of perennial and passing importance to gas engineers; and revealed the President's opinions on, and experience in connection with, several of them.

One paragraph of the address referred to a matter which has of late been engaging the minds of many in the profession—the desirability of having at the head of the great gas industry one united representative organization. "The "time has now come," said the President, "when there "should be no division in our ranks, and Associations such "as this should have only one head or parent Institution, "and not two, as at present." And then he urged our recent entreaty to "let the century now fast approaching "its end close in peace and unity, at any rate so far as "the Gas Institutions are concerned." His words fell on sympathetic ears and responsive hearts; and they drew from the President of the Gas Institute, Mr. E. H. Stevenson (who had taken the opportunity of a visit to the North to attend the meeting), a promise that, during his year of office, he would work as strongly as he could to bring about the reunion so devoutly desired throughout the length and breadth of the land. Union is now practicable; and that which is practicable is possible. What is wanted is someone strong and courageous enough to take the first step. Who will take it?

Only one paper was read; but it ranks among the most meritorious compositions presented at District Association meetings during recent years. Its author was Mr. John Carter, and it was devoted to an examination (for the first time at an Association meeting) of the recent report of the Home Office Committee on water gas. Mr. Carter, with justifiable reason, feels somewhat irritated by the sluggish pace at which the inquiry proceeded, and the delay of definite action upon the report. Had it not been for this inquiry, Lincoln would, in all probability, months since have been in possession of a carburetted water-gas plant. Upon the Committee's recommendations, Mr. Carter puts the best complexion possible from a gas engineer's standpoint; but his views, we are afraid, will not meet with general acceptance. He appears to consider that the Committee have held the scales fairly between the consumer and the gas supplier. On the one hand, by the night limitation of the carbon monoxide in the distributed gas, they protect the former; and, on the other, even with this restriction, they leave ample room, by allowing freedom in distribution during the daytime, for the useful employment of carburetted water-gas plant on many gas-works in the United Kingdom. We fear that, if the suggested conditions are imposed, the usefulness of the plant will be largely confined to those works where, owing to the nature of the district of supply, it is perhaps the least required. In the discussion, there was a clever adverse criticism of the claims and advantages of water gas by Mr. R. G. Shadbolt; but its sting was somewhat alleviated by the fact that some of his calculations were based, not upon the position of water-gas manufacture in this country to-day, but upon that existing before the Home Office Committee commenced their sittings. The discussion was an excellent one, and many forcible points were made which are worthy of attention. This was the first meeting after the passing of the rule establishing the class of associates; and six men of reputation in the gas industry were elected. But it cannot be said that the rule has had the effect intended by its proposer; and, so far, the comments made upon it in these columns on a previous occasion have been justified.

The Legal and Moral Responsibilities of Directors.

SHORTLY before rising for the Long Vacation, the Court of Appeal delivered a judgment, from the report of which lengthy extracts are given elsewhere in the "JOURNAL," which, embodying as it does some noteworthy dicta upon, and rehearsing much interesting evidence concerning, the duties and responsibilities of directors and auditors, and the relation between the capital and revenue accounts of public companies, cannot fail to be of considerable interest to our readers. The facts of the case upon which the Supreme Court had to adjudicate are, briefly, as follows: The National Bank of Wales, upon its amalgamation with the Metropolitan Bank of England and Wales, was voluntarily wound up. The consequent investigation of its affairs revealed the fact that, after providing for all liabilities, there was not only nothing left of the paid-up capital of the Bank, but, further, a deficit of some £41,000, which the shareholders were liable to make good by means of a call upon the unpaid capital. It was found that false and misleading balance-sheets had been issued to the shareholders; and the Chairman and the General Manager were charged with, and convicted of, fraudulent conduct. Before, however, proceeding to make a call upon the shareholders to meet the ascertained deficit, the Liquidator in the winding-up of the Company issued a misfeasance summons, under the Companies (Winding-up) Act, 1890, against Mr. John Cory, a former Director of the Bank, seeking to make him liable for the amount of dividends wrongfully paid to the shareholders, with his tacit consent during his term of office, and also for the losses incurred by the Bank through the making of improper and unsecured advances out of its funds, in contravention of the Articles of Association. Mr. Cory was apparently selected from among the other former Directors as the object of these proceedings on account of his wealth. Mr. Justice Wright, before whom the summons was heard, found for the Liquidator in regard to the dividends improperly paid to the shareholders, and ordered Mr. Cory to pay to that official a sum amounting, with 5 per cent. interest, to £54,000. The claim that Mr. Cory was liable to make good the losses incurred was held to be not established. Mr. Cory appealed, and the Liquidator cross-appealed, against this judgment. The Supreme Court allowed the appeal, and dismissed the cross-appeal—ordering the Liquidator to pay the costs of both hearings.

The grounds on which the Court based their judgment were that Mr. Cory had been as much deceived as the shareholders had been by the Chairman and the General Manager, and that, although he might undoubtedly have exercised greater care and vigilance, the Court were not prepared to say that, in point of law, he was guilty of any breach of duty in not discovering that those whom he trusted were misleading him. "Business," they said, "cannot be carried on upon principles of distrust. Men "in responsible positions must be trusted by those above "as well as by those below them, until there is reason to "distrust them. We agree that care and prudence do "not involve distrust; but for a director acting honestly "himself to be held *legally* liable for negligence in trusting "the officers under him not to conceal from him what "they ought to report to him, appears to us to be laying "too heavy a burden on honest men." This dictum seems both good law and good sense. But it does not remove, but rather calls attention to, the heavy *moral* responsibility devolving upon directors to exercise the greatest care and prudence in their appointments to responsible positions, and to be most careful and prudent in their supervision of the men whom they do appoint. We would here repeat what was said in commenting upon the case of the Millwall Dock Company, that it is a commonplace of prosecutions for fraud that evidence is given to show that, until he was found out, the prisoner possessed the unbounded confidence of everybody.

The evidence, as summed up by the Master of the Rolls, respecting the manner in which the Board of Directors fulfilled, in their opinion, their duties of management, is decidedly illuminating. "No Director—unless it was the "Chairman—attended to any details not brought before "the Board by the Chairman or the General Manager." How absurd! says the reader. Why, that is simply management *pour rire*. The General Manager or Chairman who has power to decide to what the Board shall or shall not attend, and, moreover, to convey in his own way such information as is allowed to reach them, is, virtually, the master, not the servant, of the Board! It would therefore be well if directors generally were to occasionally ask themselves whether they are personally and directly acquainted with the effects of the policy for which they have made themselves responsible; with the exact financial position and prospects of the company they represent, particularly in respect of the question of depreciation of works and plant; and with—that most important factor in the success of a company—the relations, cordial or the reverse, existing between the working staff and their superiors, and between the individual superior officers themselves. Put briefly, the question which the evidence in this case may well suggest to a director is: Am I a director or a puppet?

The pronouncements of the Court on the question of

whether a company is legally entitled to pay—or, from a business point of view, justified in paying—dividends when part of the paid-up capital has been lost; the question of what losses, if any, can be charged to capital; the proceedings of the Auditors of the Bank, and other interesting points which have occurred to us in considering the report of the case, must be reserved for discussion at an early opportunity.

The Economics of the Working Classes.

Among the addresses of the "popular" order delivered before the British Association, one of the most interesting and suggestive was that read by Mr. Henry Higgs, President of the Section of Economic Science and Statistics, upon the "Condition of the People." The address was in the nature of a plea for more scientific inquiry into the domestic economy of the working man. We know a great deal about the production and distribution of wealth, we have reliable statistics as to what the working classes earn and what they save; but we have little or no exact knowledge of how they spend what they spend. We must not only know how many shillings a week a man receives, and how much of the necessaries, comforts, and luxuries of life he might thereby secure, but also how far the possible is attained in practice. An observant man has, of course, a pretty fair notion of how the average workman gets through his earnings; and Mr. Higgs himself claims to know enough to warrant his framing a pretty strong indictment against that workman—or rather, chiefly, against his wife—for the way in which those earnings are wasted or misused. But it is only by means of carefully ascertained and verified facts that economists can arouse public interest, and thereby hope to secure reforms.

The one great feature which Mr. Higgs observes in the habits of our working classes is their wastefulness—a waste due mainly to ignorance. This is particularly noticeable in regard to the consumption of food. "The number of "persons who died of starvation in the Administrative "County of London in 1898, or whose death was accele- "rated by privation, amounted to 48; and we shall be pretty "safe in estimating the total number in the United King- "dom at 500. The common and inevitable reflection is "that they might have been easily relieved from the super- "fluities of the rich; but it is true also that their sufficient "sustenance was destroyed many times over through the "ignorance of the poor. . . . A little French treatise, "'La parfaite Cuisinière, ou l'Art d'utiliser les Restes,' "strikes, in its title at any rate, the key-note of the popular "domestic economy of which we stand much in need in "England." Surely here is pointed out a direction in which gas managers might increase the comforts of the working classes, while, at the same time, extending their own business. We have had cookery lectures in abundance, and a rich harvest of gas consumption has been reaped; but they have not always met the needs of the working classes. Now, however, that the prepayment meter brings a supply of gas within the means of the artisan, would it not be a profitable enterprise to give increased attention to the provision of free cooking lectures in the poorer quarters of towns—such lectures being specially directed to teaching the workman's wife the very elements of cookery? On the allied topic of the waste of fuel, Mr. Higgs quoted Mr. Edward Atkinson as declaring that the attempts to combine cooking with the heating of a room or house are absurdly wasteful; that almost the whole of the fuel used in cooking is wasted; and that nine-tenths of the time devoted to watching the process of cooking is lost. Gas managers will not interfere if this opinion be proclaimed from the housetops.

Upon the thorny subject of dress, it is, said Mr. Higgs, perilous to venture; but he truly remarks that "the blouse "of the French workman and the bare head of the Parisian "factory or flower girl are infinitely more pleasing than the "soiled and frowsy woollens or the dowdy hats of their "English fellows." Is "dowdy," though, quite reminiscent of an English factory girl's hat? In short, Mr. Higgs is of opinion that, "given an equal income, there is probably no "doubt that a French working-class family will be better "fed and better clad than a corresponding English family "dealing in the same market."

Professor Marshall, speaking before the Royal Statistical Society in 1893, declared that "something like the whole "Imperial revenue—say, 100 millions a year—might be "saved if a sufficient number of able women went about "the country and induced the other women to manage "their households as they did themselves." We rather fancy they would need to be able-bodied as well as able women if they wished to survive the attempt; but, as Mr. Higgs remarks, these figures show, at any rate, the possibilities of greatness in the economic progress of the country which might result from attention to the humblest details of domestic life.

Who is Responsible for Damage to Lamp-Posts?

A curious little point of legal procedure was elucidated last week in the South-Western Police Court, at the expense of the Crystal Palace District Gas Company. A Company manufacturing mineral waters were proceeded against for knocking down a lamp-post by one of their vans, doing damage valued at 19s. 6d. The facts were not disputed. The defence raised was the ingenious one that section 20 of the Gas-Works Clauses Act, 1847, under which the proceedings were taken, is identical in terms with section 207 of the Metropolis Local Management Act. Under the latter Act, the employer has been held not to be liable to criminal process for the neglect of his servant in such a matter as knocking down a lamp-post. He may be responsible for the value of the damage done; but the remedy of the sufferers in this event is the civil one. Counsel cited *Harding v. Parker* in support of his contention, and prevailed. The Magistrate, after a week's consideration, decided that in such a case the master could not be held liable in his Court for the negligence of his servants; and so the Gas Company lost their cause, and had to pay four guineas costs. It was a smart defence, which one can appreciate while sympathizing with the losers. These cases of damage to lamp-columns and street-lanterns are increasing in frequency with the general adoption of incandescent lighting, with its more delicate fittings. It seems hard, on the face of it, that a Gas Company should lose the protection apparently offered them in respect to this class of injury by one of their own Acts of Parliament, merely because another Act happens to be in existence and touches upon the same matter. The beauty of this partial and piecemeal legislation is that where the Metropolis Management Act does not apply, the proceeding under the Gas-Works Clauses Act, 1847, would hold perfectly good. This is remarkable; but, unfortunately, it is not exceptional in our chaotic statute law.

British Electricians in Switzerland.

The Institution of Gas Engineers is not the only technical society that has taken a Continental holiday trip this year. The electrical engineers have done the same thing, only in greater numbers. A party of 140 members and 17 ladies, representing the electrical engineering interest of the United Kingdom, has just made a tour through Switzerland. The relative importance of the two industries of gas and electricity supply does not seem to have been preserved in these semi-formal deputations. The electricians yielded nothing to the gas engineers in the matter of blending instruction with pleasure; and they must have equally benefited from their travels in a land where electricity has gone far to compensate for the lack of coal. It appears, moreover, that the hospitality of the Continental electrical engineers and manufacturers of electrical machinery and appliances was as abundant as that of the German and Danish gas men of every degree. But there was the difference that the visiting electricians were a united body. The highly delicate question of distinguishing between "professional men" and "traders" does not seem to oppress the electricians. Can it be because they are all better able to drop the "shop" when in one another's company? At all events, the temptation to mark the difference between the two sets of pilgrims is irresistible, when one sees the electricians—headed by Dr. Thompson, and including in their party Professor Perry and Messrs. Crompton, Hammond, Mordey, Sellon, and many others—making so brave a show in the face of their German and Swiss colleagues. They also talk of going to Paris next year. It seems a pity that gas people should continue to show a divided front while their natural enemies, or candid friends, or whatever one chooses to call them, are as one in seeking after knowledge and pursuing it.

A Curiosity of Appraisement.

The glorious uncertainty of valuation for gas-works transfer has often been the theme of somewhat bitter comment by interested sections of the British public. Surprise is

not infrequently expressed at the wonderful way in which a proposed compulsory purchase sends up the value of a gas or water undertaking not previously held in particularly high esteem. On such occasions, the most amazing discrepancies reveal themselves between the views of the professional appraisers representing the vendors and the other parties to the transaction. These are all honourable and truthful gentlemen; but how differently their ideas of value are tinged by the sources of their instructions! This phenomenon is not peculiar to the United Kingdom. Indeed, we venture to say that few instances of gas or water works transfer arbitrations recorded in the "JOURNAL" exhibit such wide disagreement between the parties as is shown in a report appearing in "Engineering "Record" of the proceedings of a Commission appointed to ascertain the price to be paid by the City of Gloucester, Massachusetts, for the local water-works. It had been very properly enacted by the State Legislature that the City of Gloucester should not make water-works of its own before buying the existing undertaking—providing that the owners of the latter were willing to sell. The parties could not come to terms; and accordingly the question of value was referred to a Commission of three arbitrators. Five eminent engineers valued the property for the City at an average of $217,844; whereas three other engineers valued it for the Company at $1,279,000. It is not often that the estimates of one party work out to six times the amount of those of the other side. The proceedings before the arbitrators lasted for fifty days! We cannot pile up costs in this truly noble fashion in our own effete country. The best of the joke is that the very points out of which this enormous difference arose had already been judicially reviewed in a valid precedent; so that all the Commissioners had to do was to follow suit on the general principles of valuation previously laid down. By this means the Court arrived at the sum of $600,000 as representing the value of the property. Remarkably enough, this is very nearly the splitting of the difference between the experts; but nobody would be so impolite as to hint that the result was arrived at by so prosaic a method. Of course, the decision is not final. Finality is not easily reached by legal process in the United States. It is reported that the chief proprietor of the works contemplates appealing to the United States Supreme Court, on the ground that the award is a violation of the Fourteenth Amendment to the Constitution, which provides that no citizen shall be deprived of his property without due process of law. Such is the beauty of a written Constitution, the bearings of which, as Captain Cuttle observed, depend upon the applications thereof. The marvel is that so practical a people should consent to play at arbitration which does not arbitrate.

WATER AND SANITARY AFFAIRS.

THE shortening days and the keener air remind us that we are approaching October, when most of the Local Authorities will have resumed their regular sittings. As far as the Metropolis is concerned, the London County Council may be expected to lose no time in again bringing forward their Welsh scheme; and doubtless attempts will be made to obtain support for it on the ground of the inadequacy of the existing sources of water supply. Although the Council are compelled to acknowledge that the intercommunication scheme has been effectual in bringing the water consumers of East London safely through a critical time, they lay specially strong emphasis upon the fact that the Thames had to be somewhat heavily drawn upon to allow of this being done. But if they urge the temporary lowering of the volume of the river as a reason for resorting to the streams of South Wales as being more reliable sources of water for the Metropolis than those upon which the Companies depend, they should be in a position to support their arguments by proofs. Will they be able to do this? When discussing this subject last year, we pointed out that the condition of some of the Welsh streams at the time of the drought precluded the possibility of placing implicit reliance upon them. We had the authority of an eye-witness for the statement that river banks which should have been covered were laid bare to an extent unremembered by the present generation; and it was supported by the able special correspondent of "The Times," who, in a well-timed article on the subject, pointed out that, although these streams do not actually disappear and become dry land, they shrink to such small proportions as to be dry for hydraulic purposes. He went on to direct attention to the fact that the Engineers of the Welsh scheme say nothing about the flow of the rivers; their estimates being based upon the rainfall. But although the rain, as travellers in the Principality are aware, is sometimes abundant, this is by no means the normal condition, as testified by a letter addressed by Mr. John Lloyd to "The Times" last week. He says that the River Usk, at Brecknock, has not been affected by the rain which has lately fallen, and is "lamentably low." A local Canal Company take the whole of the river except a "feeble stream "3 inches deep by 2 ft. 9 in. wide." The last rise of the river was on the 19th of May, but since this date there has been no rise whatever of any account; and Mr. Lloyd warns those who go to Wales for a water supply that they "must certainly make their reservoirs large enough "to meet a six months' drought, if they wish to be safe."

But why should we depend upon Welsh rivers for our water when we have in our midst a source having such recuperative power, so to speak, as the Thames? Only a few weeks ago, the river was so low as to frighten the Water Committee of the London County Council; but after the storm of the 6th inst. it soon came up again to its average flow. In that week the daily average was about 300 million gallons; and by this time it is probably very much over that quantity. That it will go on augmenting as the year draws to its close, there is no reason to doubt, judging from what has happened in the past. Last December, the average daily flow at Teddington was no less than 1513 million gallons. The condition of the river, as the Local Government Board have just pointed out, depends upon the rainfall. The mean for the Thames watershed, which comprises an area of 3500 square miles, has been estimated at 27 inches, of which, however, a large proportion is lost by evaporation and percolation. But there is ample justification for reckoning the daily yield of water by the river at something like 500 million gallons. This seems to support the contention of the late Sir Edward Frankland and others, that we have at our doors a source of water ample for the supply of the Metropolis for some years. All that is wanted is, to quote the Local Government Board once more, "additional storage power." This, of course, was recognized at the time of Lord Balfour's Commission; and the Staines scheme of Messrs. Hunter and Fraser—now being pushed forward so energetically by Messrs. John Aird and Sons—was the result. If the reservoirs comprised in that scheme had been in operation, there would have been no cause for anxiety this summer as to the Metropolitan Water Supply. It would admittedly be useless to construct reservoirs if there were no water available for filling them; but we think it has been shown that there would be abundance. Water engineers have hitherto been averse to taking water from rivers when in flood; and certainly, as Mr. Hervey, the Engineer of the West Middlesex Water Company, pointed out at the last conference of the Institution of Civil Engineers, it is desirable, if possible, to allow the first flush of flood water to pass before taking it into subsidence reservoirs. But he showed very clearly that this is not absolutely necessary; and he made out a strong case for the utilization of flood water after it had been submitted to the two processes of subsidence and filtration, and to the "bleaching" action of sunlight to improve its colour. Interest in this question has been revived by the able paper read by Professor Henry Robinson at the recent congress of the Sanitary Institute, and given in the "JOURNAL" last week. He expressed the very definite opinion that "the right solution "of the question of the future supply of water to London "will be found in storing the vast volumes which pass off "the watersheds of tributaries of the Thames." He thinks there is grave need of well-considered and comprehensive treatment of watersheds, to allow of the storage of flood waters, so as to make the flow of rivers more equable, and render the excess water, which now is the cause of mischief, available for domestic supply; and he suggests the constitution of an authority "free from the sphere of local "influence and conflicting interests" for dealing with the subject. This question, together with that of the control of watershed areas, which, it may be remembered, was an important item in the *agenda* for the last meeting of the British Association of Water-Works Engineers, may possibly come into prominence before next session.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 775.)

THERE have been few weeks in which business has been so limited as last week's. The defiant reply of the Transvaal Government caused the markets to open very flat on Monday; and though a rumour was later on set afloat to produce a better feeling, it would not work, and everything fell flat again. The markets continued in a state of grave apprehension, which paralyzed activity; and on Friday things were about at their worst—Consols being down to 104⅛. But then a report of what had transpired at the meeting of the Cabinet infused a little more cheerfulness; and on Saturday there was a slight recovery. Still, on balance, every department has been hit; and prices all round have dropped more or less. The Money Market is scarcely changed; operations being on a very reduced scale. In the Gas Market, although transactions cannot be said to have amounted to much altogether, yet there was a little more disposition towards activity than there was a week ago. Alterations in value were neither many nor large; and they were rather irregular. But, on the whole, the depressing influence of the prevailing flatness produced a fair share of backward movements. In Gaslight issues, the ordinary opened unchanged, and marked as good as 106½; but it soon fell away to much lower figures; and on Friday it touched 104, the quotation dropping a point-and-a-half. The secured issues, however, were steady; and the maximum even managed an advance of a point. South Metropolitan was almost untouched, and made no sign. A few bargains were done in Commercials at the old figures. Among the Suburban and Provincial Companies, the only one to show any vitality was Brighton, which changed hands at good medium prices; and the only change was a rise in Alliance and Dublin. There was a little more animation in the Continental group, especially Imperial, which was a point easier. None of the rest were conspicuous, except San Paulo, which had a sharp drop just at the close. Business in the Water Companies showed a rather increased volume. Changes were few, comprising a slight fall in East London, and a marked advance in Lambeth debenture stock, which is now priced higher than the corresponding New River stock.

The daily operations were: Very moderate business was done in Gas on Monday; and the tendency was rather easier. Gaslight ordinary fell 1. Tuesday was a particularly quiet day; and quotations did not move. Wednesday brought about something of a revival of business; but still prices held on unchanged. In Water, Lambeth debenture rose 2½. Some fair prices were marked on Thursday; and Gaslight maximum improved 1. In Water, East London receded 1. Friday's transactions were mostly in Gaslights; ordinary falling ⅛. Imperial also lost 1; but Alliance rose ⅛. Saturday was quiet; and the only feature was a fall of 1 in San Paulo.

ELECTRIC LIGHTING MEMORANDA.

Electricity at the British Association Meeting—Professor Fleming's Lecture—Breakdown of the Manchester Corporation Electricity Supply—The Constant Risk of Failure.

ELECTRICITY figured prominently among the subjects discussed at the Dover meeting of the British Association. The great novelty of the meeting was wireless telegraphy; many messages being sent by the Marconi apparatus from the Dover Town Hall to Wimereux on the opposite side of the channel. The realization of an advance of this kind, before the eyes of such an assemblage, sets the seal upon the achievement. It is impossible for the coolest-headed observer of the progress of science and engineering on the arduous and illimitable road of conquest over the resources of Nature, to witness unmoved the sending of an inquiry from a lecture platform on land to the patient watchers in the East Goodwin lightship. Let it stand for a record, that at 10 p.m. on Sept. 18, Professor Fleming sent by Marconi wireless telegraphy from his lecture table in the Dover Town Hall the following message to the East Goodwin lightship: "What kind of night is it on Goodwins? Are you all right? Do you want the lifeboat sent? Reply at once. Town Hall, Dover." In ten minutes the reply was received: "Fresh breeze here, swell, wind west. Number five breeze. No; we don't want the lifeboat. To the Town Hall, Dover, from Ashby, lamplighter." Mention of this message renders it necessary to remark that Professor Fleming's lecture on "The Centenary of the Electric Current" was in all respects a worthy setting forth of a great and inspiring theme. It should scarcely be necessary for us to state here that the followers of the gas industry are second to none in their appreciation of the value to humanity of the great branch of science that originated with Volta just one hundred years ago. What they, and the "JOURNAL" representing them, have resisted is merely the pretension of some of Volta's commercially-minded disciples to the succession to their business. Electrical science we all respect; it is only the blend of the commercial traveller with the electrician whom we hold in despite.

It is not for us to paraphrase Professor Fleming's masterly demonstration of the manner in which man has, step by step, discovered the attributes and useful applications of a form of energy into the nature of which he has never been able to penetrate. Truth to tell, men of science have tacitly resigned themselves to this ignorance of the nature of electricity, and do not feel it as a reproach. They regard the question as belonging to a byegone cast of thought, referable to a stage of man's mental development when he deemed it essential to begin his knowledge of things with a precise definition of what they were in themselves. This was, if not a mistaken way of looking at the universe, at least an unfruitful one. Science became reproductive when it bye-passed the essential nature of its subjects, and concerned itself wholly with their operation on other things. So with modern electrical science, all its multifarious gains have come from the observation and investigation of phenomena. Not what electricity is, but what it does, is the fruitful inquiry. At the same time, it is impossible to put a direct question to Nature, in the form of trying a new experiment in physics, without bringing into use some idea of the character of the forces invoked. Professor Fleming and his able assistants arranged on the 18th inst. a lecture such as, one is proud to think, could not have been paralleled out of England. Starting with the discovery by Volta of the means of generating a continuous electric current, the lecturer took the line of development of this initial inroad into the Unknown which led up to Marconi telegraphy. He might have taken other courses, and conducted his audience to the phenomena of electric lighting, power distribution, or X-rays disclosures. One line, however, was enough for the occasion; and it is no small triumph for Professor Fleming to have succeeded in leading his audience to see in Marconi's proceeding the most natural development of the originating discovery by Volta a hundred years ago.

An accident of considerable gravity in itself, but of even greater significance as an "object lesson," has just occurred at the central lighting station of the Manchester Corporation. According to the report of the occurrence in the current number of the "Electrician," which we take to be authoritative, at about 6 o'clock on the 19th inst., when the district was just lighting up, the belt on one of the twelve 400-horse power Galloway-Edison-Hopkinson sets broke, and carried away the engine-governor. The engines are compound condensing, running at a speed of about 80 revolutions per minute. They drive the dynamos through leather belting, and stand side by side in an imposing-looking row. The moment the watchful attendants saw the belt break, "the dynamo was switched off, the steam shut off at the stop-valve, and the vacuum broken." But it was too late to prevent terrible mischief. Before the stop-valve could be closed, the engine started racing under the full head of steam by reason of the governor being carried away. The fly-wheel burst simultaneously with the closing of the valve, wrecking the next engine. The pieces of the rim rebounded from the stout walls of the engine-room, damaging the plant in all directions. The two engines and their dynamos were completely smashed; and, the steam and water connections being disabled, the generation of electricity was stopped. The supply was only resumed at 4.15 the following morning; and this quick reparation of a general wreckage was due to the ingenuity and promptitude of the engineering staff. The greatest marvel is that only two men—the driver and a greaser—were injured; and this only by serious bruising. Our electrical contemporary admits that "much inconvenience was caused in the town by the stoppage of the supply," but none the less praises the staff for their repairing work "under what must have been most trying conditions." The laudatory notice is deserved; yet it is plain that the public look at the occurrence from a different standpoint. Unfortunately, there was another failure on Sunday night, owing to something having gone wrong with one of the mains.

As we have had many occasions for asseverating, the chief care of the public is that their artificial lighting, whatever it is, shall be reliable. In the early days of electric lighting, the partisans of the new illuminant flattered themselves that they had said all that was necessary in explanation of the frequent breakdowns when they could lay the blame upon a defective feed-pump, or something of the kind alleged to be outside "the system." This is a delusion. The public does not care whether the cause of the town being plunged in partial darkness is one thing or another. The fact remains; and that is sufficient. The Manchester complaint is that there is "something radically wrong" with the local electric supply; and it is urged that the Electricity Supply Committee ought to make more sure of their ground as they go along. This is deplorable ignorance and cavilling, from the electrical engineer's point of view. The truth of the matter is that mere bulk in electricity generation counts for nothing as regards reliability. The biggest engine may break down as hopelessly as, and far more dangerously than, the smallest. We seem to remember also that the electrical journals have published views of the storage batteries used in Manchester, in long perspectives. Where were these, this day week? The most cunningly-devised steam-power station, with all its ingenious arrangements for economizing fuel and assuring the continuous supply of current, is, and must ever be, at the mercy of a belt, a pin, or a connecting-rod. The most powerful liner that ever bridged the Atlantic may be reduced in a moment to a floating log through the breaking of a crank-shaft. So it is with the best-equipped electric lighting station. Let this be remembered, and then let us all be thankful that there are such things as gasholders!

GAS ACTS OF 1899.

THE following Acts relating to gas supply in the United Kingdom were passed last session. We summarize their principal provisions in our customary order, beginning with the Acts incorporating new gas companies or conferring statutory powers upon previously established limited companies.

The Cobham Gas Act incorporates a Company with a share capital of £15,000, and power to borrow £5000, for the purpose of supplying with gas a district comprising the parishes of Cobham and Stoke d'Abernon, and so much of the parish of Byfleet as lies to the east of the River Wey Navigation Canal. It is provided that if the power of supply in the parish of Byfleet is not exercised within five years, the dormant right of the Woking District Gas Company, Limited, to this area shall be resumed. A clause is inserted to protect the rights of the Walton-on-Thames and Weybridge Gas Company. Land for a site for works is scheduled for compulsory purchase within three years. The Company are to purchase the entire undertaking and works of the Cobham Gaslight and Coke Company, Limited. Clauses are inserted for the protection of the Surrey County Council. Power is given to deal in and hire out, but not to manufacture, gas apparatus and fittings. The maximum price for 15-candle gas is to be 5s. per 1000 cubic feet. The period of error in defective meters is limited to the previous quarter of the year. A penalty of £5 is enacted for wilfully injuring meters or fittings. The Company may supply gas in bulk beyond their limits by agreement, and may apply for electric lighting powers.

The Crowborough District Gas Act incorporates a Company with a capital of £24,000 in £1 shares, and power to borrow £6000, for supplying gas within the parishes of Crowborough, Mayfield, Buxted, and Hartfield, in Sussex, and so much of the parishes of Rotherfield, Withyham, and Frant, in that county, and Speldhurst, in Kent, as lies outside a radius of four miles from the centre of the western door of Holy Trinity Church, Tunbridge Wells. The Company may acquire 5 acres of land by agreement. Pipes must be laid below a depth of 2 ft. 6 in. from the surface of any road maintained by the East Sussex County Council. The undertakings of the Crowborough and Mayfield District Gas Companies are to be acquired by the Company. The Company may deal in, but not manufacture, gas-fittings. The maximum price of 15-candle gas is to be 5s. per 1000 cubic feet. No penalty is to be incurred in respect of unavoidably defective supply. Meter-rents are to be 15 per cent. on cost, payable quarterly in advance. All consumers' deposits are to bear 4 per cent. interest. The Company are to have access to meters at reasonable times. The period of error in defective meters is limited to the last preceding quarter. Consumers leaving without notice are liable to pay for all gas consumed up to the next index-taking, or to the date of the next subsequent consumer's application, whichever shall first occur. Notice of this obligation is to be given in every demand note. There is a penalty of £5 for injuring meters. The Company may apply for electric lighting powers.

The Fishguard Water and Gas Act incorporates a Company for the supply of gas at the place named, in Pembrokeshire, with an undivided capital of £16,000 in £1 shares, and £4000 loan capital. The maximum price is 5s. 6d. for 15-candle gas; and the same clauses as to dealing in stoves, &c., as in the preceding Act, are inserted. The Company's powers of entry on consumers' premises are to be exercised between the hours of 9 and 4; and refusal of admittance may be visited by a £5 penalty. Connecting or disconnecting meters without 48 hours' notice is forbidden, under a penalty of 40s. The Company may apply for electric lighting powers.

The Ilford Gas Act confers statutory powers on a Gas Company formed under a deed of settlement in 1839. Provisional Orders were obtained by the Company in 1873, 1881, and 1894. The capital of the Company consisted of £5000 in original shares, and £32,890 in 7 per cent. shares. There was also a mortgage debt of £13,475. The district of supply is defined on a map. The capital of the Company is increased to £250,000; the nominal amount of the old capital being doubled. The additional capital is entitled to 5 per cent. dividend. Borrowing powers are granted to the extent of one-third of the paid-up share capital. The old mortgage is to be paid off. The standard price is continued at 4s. 6d. per 1000 cubic feet. Additional gas lands are to be compulsorily acquired. Part of a watercourse called the Aldersbrook is to be filled in and appropriated, under certain conditions. Discounts up to 20 per cent. may be allowed to consumers.

The Mid-Kent Gaslight and Coke Act incorporates a Company for the supply of gas to an extensive district bordering on that of the Tunbridge Wells Gas Company, subject to the acquisition of the gas-works, in private lands, already supplying part of the area. In the district of Malling, the supply must be made effective within six years. The capital of the Company is £140,000, with power to borrow £35,000. A site for works is to be compulsorily acquired within three years. The sliding-scale is applied, with an initial price of 4s. per 1000 cubic feet. The Company may apply for electric lighting powers, and use their capital for carrying such powers into effect; and they may erect dwelling-houses for their employees. Power of inspection of new fittings is given, with a right of refusal to supply to unsatisfactory fittings.

The Redditch Gas Act incorporates a limited Company formed in 1872. Provisional Orders were obtained in 1873 and 1882, fixing the share capital at £20,000 in original 10 per cent. shares, £10,000 in 5 per cent. preference shares, and £5000 borrowed on mortgage. The capital of the Company is now £45,000 ordinary and £15,000 preference 5 per cent. stock, with power to borrow one-fourth. The Directors may declare an interim dividend without calling a general meeting. The standard price is 4s. 6d. per 1000 cubic feet supplied within the urban district of Redditch, and 5s. per 1000 cubic feet outside. The provisions of section 11 of the Gas-Works Clauses Act, 1871, are to be read and applied within the urban district as if 50 feet instead of 30 feet were the distance enacted therein.

The Rushden and Higham-Ferrers District Gas Act incorporates a Company founded in 1892. The district of supply is defined so as to exclude an area supplied by the Irthlingborough Gas Company, Limited. The capital of the Company is £40,000, equally divided between original and additional capital, with one-fourth loan. Interim dividends may be declared. Additional lands are to be compulsorily acquired. Pipes may be laid in undedicated roads. The initial price of gas is 3s. 6d. per 1000 cubic feet for Rushden and Higham Ferrers, and 5s. beyond. Discounts of not exceeding 2d. per 1000 cubic feet may be allowed for prompt payment. The Company may apply for electric lighting powers. The Local Authorities for the places already named may promote a Bill for acquiring the undertaking in the next three sessions of Parliament, without opposition on the part of the Company, except on clauses. The public lamps are to be supplied at the lowest price to any private consumer, including discount.

The Shirebrook and District Gas Act incorporates a Company for supplying gas to a district over which the Mansfield Improvement Commissioners have statutory powers that have remained dormant since 1878. The share capital is £50,000, with power to borrow one-third. Land for a gas-works site is to be compulsorily acquired. The prescribed period for the sale of superfluous lands is twelve years. The sliding-scale is enacted, with an initial price of 5s. per 1000 cubic feet. The rate of interest payable on consumers' deposits is 3 per cent. The Company may apply for electric lighting powers. Sums due to the Company under £50 in amount are recoverable in the County Court.

The St. David's Water and Gas Act incorporates a Company with an undivided capital of £16,000, with power to borrow one-fourth, for the purpose of supplying gas in the city named, at the maximum price of 6s. per 1000 cubic feet.

The Bristol Gas Act follows a stock conversion Act of 1891. The old capital powers are stated in a schedule; the total authorized capital stock being £1,022,500, and of loan capital £255,625. The additional capital authorized by the Act is £300,000, with power to raise one-third of the same amount in debenture stock. New lands are to be acquired for storing gas, subject to a clause protecting the Bristol Water-Works Company. Gas apparatus that has been lent on hire is made free from distress. An important precedent is created in clause 25 of the Act, which empowers the Company to prescribe the position of consumers' meters and the quality of consumers' fittings, under certain conditions. We give the clause in full:—

1.—Every meter, whether supplied by the Company or not, by which the gas supplied or to be supplied to any house or building is or is intended to be measured, shall be placed in such position within such house or building as the Company shall reasonably prescribe, and so that the same shall be as near as practicable to the outside wall of the house or building nearest the road or street in which the main through which the supply is or is intended to be drawn is situate, and so that such meter, and all pipes and fittings connected therewith, shall, as far as practicable, be open to the inspection of the officers of the Company: Provided that the Company shall not be entitled to require the alteration, at the expense of the consumer, of the position of any existing meter, except upon a change of occupancy of the premises in or upon which such meter is now placed.

2.—The Company may, by notice in writing, require the substitution, for any pipes or fittings situate between the Company's mains or pipes and the meter on any consumer's premises which may in the opinion of the Company, by reason of improper material or arrangement, inferior workmanship, or insufficient size, be calculated to allow of the escape of gas, or be insufficient for ensuring a satisfactory supply of gas to such premises, of pipes and fittings of such size, workmanship, and material, and so arranged, as the Company shall reasonably prescribe; and such prescribed pipes and fittings shall be set up, fixed, or laid under the superintendence and to the reasonable satisfaction of the Company, and in such position as they may reasonably approve: Provided that the Company shall not be entitled to require such substitution at the expense of a consumer except upon a change of occupancy of the premises upon which such pipes and fittings are situate, nor in any case in which such pipes or fittings were laid under the direct superintendence or with the approval in writing of the Company.

3.—In the case of new buildings or premises not previously supplied with gas, the pipes and fittings between the main and the meter shall be of such material and workmanship as the Company shall reasonably prescribe, and shall be set up, fixed, or laid under the superintendence and to the reasonable satisfaction of the Company, and in such position as they may reasonably approve.

4.—If any person fail to place such meter, or to adopt, set up, and lay down such pipes and fittings, on any premises in accordance with the requirements of the Company, the Company shall not be bound to furnish a supply of gas to such premises, or may cut off and discontinue the supply of gas to such premises.

5.—Any question as to the reasonableness of any requirement of the Company made under this section shall be settled by two Justices sitting in Petty Sessions, provided application be made within one month after the date on which the requirement shall have been made by the Company.

The use of anti-fluctuators may be required on all gas-engine services.

(*To be continued.*)

OBITUARY.

Mr. T. HAMILTON URRY, the Chairman of the Ventnor Gas and Water Company, died on Monday last week, after an illness extending over a considerable period. He was a Solicitor by profession, and was much respected in the town.

The death took place last Tuesday afternoon, after a long and painful illness, of Alderman JOSEPH BROOK, one of the oldest members of the Halifax Town Council. Mr. Brook, who was about seventy years of age, had sat in the Council continuously since 1885, prior to which date he was a member from 1880 to 1883. For many years he was Chairman of the Gas Committee, and at the time of his death occupied the position of Vice-Chairman.

A distinguished French chemist has just passed away in the person of M. SCHEURER-KESTNER, who succumbed last Tuesday morning to an attack of typhoid fever. He was one of the most brilliant pupils of Professor Wurtz; and he embarked upon several industrial enterprises, which for many years he managed, at Thann, in Alsatia. Having made a fortune at an early age, he entered the political arena as a Moderate Republican; and was at one time Vice-President of the Senate. His name has lately been prominently before the world in connection with the Dreyfus affair; it being due to his initiative that the revision proceedings were instituted which have resulted in the pardon of the accused.

PERSONAL.

Mr. J. LEE, the recently-appointed Secretary of the Carnforth Gas Company, is filling a similar position with the Water Company, in succession to Mr. Orr.

Mr. J. B. BROWN has resigned the Chairmanship of the Hebden Bridge Water-Works Committee; and Mr. THOMAS SUTCLIFFE has been appointed in his place.

Mr. M. A. ADAMS, whose name came prominently before our readers at the time of the epidemic of typhoid fever at Maidstone two years ago, has resigned the position of Medical Officer of Health for the borough.

Mr. R. M. COUPER, who a few months ago was appointed Manager of the Wells (Somerset) Gas-Works, has resigned his position, and has been succeeded by Mr. H. ALLEY, Assistant to Mr. Sainsbury at Trowbridge.

The roll of freemen for the borough of Carnarvon was opened last Thursday by the admission to that honour of Sir WILLIAM H. PREECE, K.C.B. Carnarvon is Sir William's birthplace; and his father was at one time Mayor of the town.

The Falmouth Corporation have decided to engage the services of Mr. A. SILVERTHORNE to advise them in matters connected with their water supply, and Mr. W. A. VALON to report upon the sewerage and a scheme of sewage disposal.

The name of Mr. GEORGE BRAY is associated, in the minds of most of our readers, with the manufacture of gas-burners; but that his business does not absorb the whole of his attention was shown, curiously enough, at the recent meeting of the British Association at Dover. For the past three months, the Yorkshire Geological and Polytechnic Society have been investigating, at the instance of Mr. Bray, the springs and underground waters which form the source of the River Aire; and the labours of the Committee entrusted with the investigations have resulted in the establishment of facts which have eluded all previous workers at the problem. The Committee drew up a report on the subject, and an interesting paper thereon was read by Professor P. F. Kendall, in the Geology Section, on Monday last week.

The After-Formation of Gas in Acetylene Generators.—In a recent number of the "Metallarbeiter," the above subject is dealt with by Herr P. Wolff. He points out that an inherent fault in all acetylene generators is the formation of gas which takes place after the direct contact between the carbide and the water has ceased. This generation is due to the action of the residual water contained in the pores of the carbide, to the condensation of water on the surface of the carbide, and also to the absorption of aqueous vapour. The author measured the quantity of gas thus liberated by 1 kilogramme of carbide by passing it through a meter. In one series of experiments the carbide reservoir was over water; in another, it was over petroleum. The results showed that in the latter case the quantity of gas formed amounted to 0·25 litre at the end of the first half hour, to 6 litres after 24 hours, and then remained constant at 16 litres at the end of three days. In the first case, on the other hand, 7·5 litres were collected in half an hour, 25 litres in 24 hours, and 30 litres at the end of three days; after which time the liberation of gas continued at the rate of from 5 to 6 litres per day until the integral decomposition of the carbide was complete. Different means have been proposed for obviating this inconvenience, but the most efficacious method appears to be that of Münsterberg. A valve closes all communication between the carbide reservoir and the water as soon as the former has been raised; the after-formation of gas is therefore no longer produced except by the water contained in the pores of the carbide.

NOTES.

The Efficiency of the Human Machine.

The mechanical efficiency of the human body has often been compared, with presumed advantage, to that of steam mechanism. It has been difficult to verify these comparisons, because of the absence of reliable data respecting the true efficiency of the human machine as a prime mover. An attempt to solve this problem experimentally has been made by M. Chauveau, who has published his results in the "Comptes Rendus." In order to arrive at a positive record of the expenditure of energy by the living subject in doing a known amount of work, a calorimetric development was made of the classical experiments of Watts and Rumford by which the unit of power was determined. The work was done upon a treadmill, surrounded by a small chamber calibrated as a radiation calorimeter. By means of an ingenious system of mechanical and thermometric adjustments, it became possible to ascertain the production of heating effect corresponding to the amount of effort exerted. The first series of experiments gave very concordant indications. From a number of observations, it was deduced that when the human subject was doing useful work at the rate of 64 calories (255 British thermal units) per hour, he also radiated from his body extra heat amounting to 199 calories (517 British thermal units) per hour. The thermal efficiency of the human mechanism was therefore about 24·3 per cent., calculated in the usual way—about the same, that is to say, as a modern gas-engine. This determination must be taken for what it is worth.

Multiple Lightning Flashes.

An interesting communication relating to the character of lightning strokes, has been sent to "Engineering" by Mr. J. T. Bucknill, referring to an example that occurred at Southampton on July 22. The problem of thoroughly protecting buildings from lightning is now generally accepted by engineers as being more complex than it was formerly thought to be, at a period when one lightning conductor on the highest object was credited with the power of protecting other and lower objects in its vicinity. In the example in question, four strokes were delivered simultaneously, taking effect upon as many objects of different heights within a circle of about 100 feet radius. The highest object within the same circular area was not touched. Not much damage was done; the objects being all wet, which circumstance conduced to the safety of the structures. Some fuses to protect electric wires were burnt out, and the soot was driven out of one of the chimneys struck. Mr. Bucknill calls this an example of the "multiple stroke," and declares that it disposes of the notion that higher points in the vicinity will afford protection to lower points, notwithstanding the excellent roads to earth offered by the former when they happen to be soot-covered chimney flues. The division of the stroke, he thinks, is probably occasioned by earth charges previously accumulated by induction at the points subsequently struck by the flash. Relative altitude is evidently not to be relied upon, since the highest points are not of necessity struck. Nor do lower points escape if the flash is sufficiently powerful to divide itself effectually.

Mr. Greville Williams and Artificial India-Rubber.

Another example of the deferred productiveness of experimental research, which at the time seems devoid of practical issue, is furnished by what has recently occurred in regard to the artificial production of india-rubber. It is unnecessary to lay stress upon the industrial importance of this natural product, the demand for which is already enormous, and increases every year, as new uses for it are found, faster than the visible sources of supply. Many years ago, Mr. Greville Williams, who is best known to most of our readers as a specialist in gas and coal tar chemistry, discovered among the products of the destructive distillation of india-rubber a hydrocarbon which received the name of isoprene. This residual product did not appear to be particularly noteworthy at the time, apart from its own identity as a very volatile fluid hydrocarbon, boiling at about 36°. Its molecular formula is C_5H_8; and it forms a tetrabromide, but has no metallic derivatives, like the two homologues of acetylene. In 1884, Dr. Filden observed the same substance among the more volatile compounds resulting from the action of a moderate heat upon oil of turpentine and other terpenes. Dr. Tilden made samples of isoprene from several turpenes in the course of his investigation into these compounds; and some of these were preserved. Upon examining these relics recently, Dr. Tilden was surprised to find the contents of the bottles of isoprene from turpentine entirely changed in appearance. Instead of Greville Williams's limpid, colourless fluid, there was a dense syrup in which floated several large masses of a yellowish solid. This was india-rubber. The substance exactly resembled Para rubber in every essential particular. Naturally, Professor Tilden has tried everything he could think of as likely to hasten the change; but so far without success. The process of polymerization proceeds very slowly, occupying several years; and all attempts to hurry it result in the production, not of rubber, but of colophene—a thick, sticky oil, quite useless for all the purposes to which rubber is applied.

Warming by Exhaust Steam.

The application of electricity supplied from central generating stations to the warming of houses, as well as to lighting them,

has long been the dream of aspiring electricians; and at exhibitions of electrical apparatus experimental appliances for this purpose have frequently been shown. That the idea is not now regarded as practicable by the business heads of American electricity supply undertakings, is to be inferred from the circumstance that the management of the Narragansett Electric Lighting Company, of Providence, Rhode Island, have recently entertained a project for adding a steam-heating branch to their concern, which already comprises a street railway power department. Steam-heating from a central station is a thriving enterprise in the Northern States; and the consideration that led this Electricity Supply Company to look into the practicability of such a venture, was the fact of their having 4500-horse power in use for the lighting and power trade of the town. This means a good deal of exhaust steam to be disposed of by condensation or otherwise; and the Directors of the Company accordingly mapped out a district of the city surrounding their works, obtained estimates of the cost of the steam-distributing plant, and commissioned Professor J. E. Denton, of the Stevens Institute of Technology, to report upon the practicability of using their exhaust steam for this purpose. The result of the inquiry is reported in "Engineering Record" for Aug. 19 last. Professor Denton did his work very thoroughly. His report gives all the available data on which schemes of the kind may be based. It is shown, to begin with, that heating by exhaust steam means a certain amount of back-pressure on the steam plant, which also means that the engines must be worked non-condensing. The cost of this way of working, as compared with that of condensing, *plus* the cost of working against the back-pressure of at least 9 lbs. per square inch needed to keep the heating system going, must be set off against any possible value of this application of the steam. It means an increased fuel consumption of about 42 per cent. Thus there is no utilizing exhaust steam for heating rooms or factories for nothing. All the other costs of the scheme were worked out according to local conditions by Professor Denton. It is interesting to note that, in American steam-heating practice, it is customary to allow a square foot of radiator to every 80 cubic feet of interior space to be heated. Every cubic foot of space heated is calculated to take 10 lbs. of steam per season. Generally, Professor Denton concludes that the scheme submitted to him is practicable, and would return a gross profit of 20 per cent. at a charge of 35 cents per square foot of radiator per season of 243 working days.

COMMUNICATED ARTICLE.

THE QUANTITY OF NAPHTHALENE IN GAS.

By Wm. Young, of Peebles.

A homogeneous volatile substance, such as water or naphthalene, having a fixed boiling-point, has its vapour tension raised by steadily increasing increments for each degree of rise of temperature; and when a gas is brought into intimate contact with such volatile substance, the vapour diffuses through the gas in constantly increasing increments of weight per degree as the temperature rises. The table of the weights of naphthalene required to saturate a given volume of gas, compiled by Mr. R. W. Allen, M.A., which appeared in the "Journal" for the 5th inst., is not quite in harmony with this law, as is shown by the following extension of the part of the table given in grains per 1000 cubic feet.

Temperature, Degrees Fahrenheit.	Weight of $C_{10}H_8$ in Grains Required to Saturate 100 Cubic Feet.	Increased Weight in Grains for each 9 Degrees Fahr. of Temperature.	Difference in the Increments of Weight in Grains.
32	3·28	..	..
41	9·18	5·90	..
50	14·86	6·68	+ 0·78
59	20·98	6·12	+ 0·44
68	27·09	6·11	− 0·01
77	34·09	7·00	+ 0·89
86	41·08	7·99	+ 0·99
95	55·94	14·86	+ 6·87
104	100·50	44·56	+ 29·70
113	154·70	54·20	+ 19·64
122	250·80	96·10	+ 41·90
131	398·10	147·30	+ 51·20
140	546·30	148·20	+ 0·90
149	721·10	174·80	+ 36·60
158	1043·00	321·90	+147·10
167	1450·00	407·00	+ 86·10
176	1912·00	456·00	+ 49·00
185	2448·00	536·00	+ 80·00
194	2932·00	484·00	− 52·00
203	3666·00	734·00	+ 50·00
212	4567·00	901·00	+ 67·00

It will be seen that, although the divergences from the law are not very great, they are sufficient to mar the value of the figures. The increments do not steadily increase, but in two instances even decrease.

The object of this article, however, is not to throw doubt on Mr. Allen's figures, for unquestionably they are sufficiently near the truth to make them of much value; and by plotting the figures in diagram form, the errors can be to a large extent eliminated, and the data made still more valuable. But even allowing the figures to be absolutely correct, they do not furnish the necessary information to enable us to assess the actual value as an illuminant of the naphthalene usually present in coal gas. A great many other factors have to be taken into consideration before we can arrive at that information.

The table supplies us with the quantity of naphthalene that can be held in diffusion at any given temperature by what may be termed a dry permanent gas, out of contact with any substance having a solvent affinity for the naphthalene. These conditions do not, however, obtain in the case of illuminating coal gas. During the process of condensation, the naphthalene is in contact with the gas associated with a great many other hydrocarbons, some having higher and some lower vapour tensions; and it very largely depends upon the relative proportions in which these other hydrocarbons are present, and the manner in which the heterogeneous mixture is cooled or condensed, how much of the naphthalene is left in the gas. Just in proportion as the condensable solvents for naphthalene rise or fall, and the solvent power is allowed full play, or is restricted by the method of condensation, so will the quantity of naphthalene left in the gas fall or rise; and just in proportion as the volatilizable hydrocarbons rise or fall, and the condensation is conducted so as to lead to the volatilizing of the largest possible quantity into the gas, so will the naphthalene be partially replaced, and what remains will be accompanied by vapours which will take it up in solution, and prevent its being deposited as a crystalline solid, giving trouble if the gas should be subsequently exposed to low temperatures.

We thus see that the quantity of naphthalene usually present in a gas is a variable quantity, and that gases even saturated with naphthalene might not give any trouble, provided suitable hydrocarbon vapour were present in the gas along with it, to take it up in solution on its being deposited. When, however, very high heats are employed to carbonize certain classes of coal, the condensable and volatile products are so small in relation to the volume of gas, and the quantity of naphthalene in the products is so large, that, even with the most perfect system of condensation, it is almost impossible to prevent the gas leaving the manufacturing plant otherwise than highly charged with naphthalene vapour; and the quantity of volatilizable hydrocarbons present in the gas is necessarily quite inadequate to prevent the naphthalene being precipitated in the solid crystalline state. But even in that case the quantity present in the purified gas is a varying one.

As already remarked, Mr. Allen's table gives the quantity of naphthalene that saturates a dry gas—that is, a gas in which the vapours of other condensable hydrocarbons are not present. Now, with the very poorest of coal gases obtained from the carbonizing of the worst class of coals at the highest practicable temperature, every 1000 cubic feet will hold in diffusion at least 1½ lbs. of such vapours; and in the case of many of the gases that will deposit solid naphthalene, the quantity of condensable vapours may rise to nearly 3 lbs. per 1000 cubic feet. A gas already holding these hydrocarbon vapours in diffusion will not take up as much naphthalene—or, in other words, will not require so much naphthalene to saturate it—as one would without them; and therefore the amount of naphthalene present in purified coal gas at any particular temperature will not be that given in Mr. Allen's table, but will be less as the proportion of the other condensable hydrocarbons present rises.

Mr. J. P. Leather, of Burnley, in his paper on "Naphthalene Deposits," read before the Gas Institute,* makes this point fairly clear, and gives the following analysis of Burnley gas:—

	Weight in 10,000 Cub. Ft. lbs.
Benzene	15·80
Toluene	5·30
Xylene	1·45
Cumene and other compounds boiling between 300° and 380° Fahr.	0·32
Naphthalene	0·13

Mr. Leather subsequently says: "I have made several determinations of the naphthalene in the gas on the works at Burnley. The largest quantity found was at the rate of 0·2 lb. of naphthalene per 10,000 cubic feet. The gas in this case had not been cooled below 70° Fahr." The quantity given in the analysis is equal to 91 grains per 1000 cubic feet; and the largest quantity found in the case where the gas was only cooled to 70° Fahr. is equal to 140 grains. These quantities are much lower than those given in Mr. Allen's table as necessary to saturate a gas; but that it is saturated is evidenced by the fact that the gas at Burnley gives trouble from naphthalene deposits during its distribution. The difference in the quantities in Mr. Allen's table and that actually found is due to the causes referred to.

We may therefore assume that an ordinary coal gas containing 100 grains of naphthalene per 1000 cubic feet will give trouble during distribution, due to part of it being deposited in the solid form in the mains and services; and that at most not more than the above-named quantity can, on an average, be calculated upon as forming a constituent contributing to the illuminating power of the gas. One pound, or 7000 grains, of naphthalene, if diffused through 1000 cubic feet of coal gas,

* See "Journal," Vol. LXXIII., p. 1734.

will raise the illuminating power nearly 3 candles; and therefore 100 grains (allowing that it could all be got to the point of consumption) would raise it by 0·043 candle—an increase which would require very careful reading of the photometer to detect. But even this increase would not be obtained, as a part of it would be deposited out of the gas during distribution. The additions of the vapours of a liquid hydrocarbon having an approximate vapour tension to that of naphthalene (xylene) would prevent the naphthalene being deposited in the solid state; but it would not prevent its being deposited. Indeed, it would increase the quantity thrown down, due to the fuller saturation of the gas by the added vapours leading to the precipitation taking place at a slightly higher temperature.

The washing of the gas with creosote or other hydrocarbon oil to which had been added coal-tar naphtha sufficient to restrict the washing action to the naphthalene alone, would remove the latter, and prevent its deposition in the mains and services; but there would be the loss of the illuminating value of the naphthalene so removed. It is not, however, necessary to take out the whole of the naphthalene to prevent troubles from deposits, because, at the lowest temperature to which the gas is likely to be exposed, from 30 to 40 grains per 1000 cubic feet may be left in, as with such a small quantity the temperature required to cause it to deposit would be so low that the vapour tension of the other liquid hydrocarbons diffused through the gas would also be so far reduced that a portion of them would be condensed, sufficient to take up in solution any little naphthalene that would be precipitated.

The washing of the naphthalene-charged gas with creosote or other hydrocarbon oil, so as to prevent any naphthalene being deposited in the solid form, would therefore only involve the removal of from 60 to 70 grains per 1000 cubic feet—equivalent to a reduction of the illuminating power to the extent of about 0·03 candle. To restore this with benzene vapour would require something like 110 grains; and taking benzene at 9d. per gallon, the cost would be 0·016d. The restoration of the illuminating power, or even a considerable increase in it, could be both easily and cheaply effected by the addition of an excess of benzene to the creosote oil.

There is no doubt that, in the case of many gas-works, much larger quantities of naphthalene than those above noticed are present in the gas. Such naphthalene, however, is not present in the state of vapour, but suspended in an extremely fine state of mechanical division, and carried forward in the current of gas. Naphthalene—in consequence of its passing, at ordinary temperatures, directly from the state of vapour to that of a dry crystalline solid—is very liable, when suddenly cooled, and especially away from contact with the cooling surface, and by radiation, to be precipitated in that condition, and to be thus carried forward in the gas, even up to the consumers' burners. But naphthalene cannot in these circumstances be looked upon as an illuminating constituent desirable to retain in the gas, as it leads to far more trouble and expense than it is worth.

Gas, Water, and Electric Lighting Statistics.—We have received from Messrs. Hazell, Watson, and Viney, Limited, their "Gas and Electric Lighting Works Directory and Statistics, 1899," and "Water-Works Directory and Statistics, 1899." This is the 23rd edition of both works; and the publishers state that the contents have been revised up to the 1st of July. The proof of the accuracy of the information contained in such books as these is in their use; and only in this way will it be possible to verify the above statement. In previous editions there has been room for improvement; and although more care has been bestowed upon the correction of the data, additional vigilance appears to be needed. The particulars as to electric light undertakings have been further extended.

The Utilization of Waste.—Writing on this subject in the current number of "Cassier's Magazine," Mr. John Birkenbine points out that some of the prominent utilizations of waste products which are well known to-day are in connection with the fuel supply. In the production of charcoal from wood there are large volumes of acetic vapours which, when condensed, are of considerable value. By charring the wood in ovens or retorts, and conveying the vapours to condensers and stills, the products are charcoal, pyroligneous acid, tar, and uncondensable gases of considerable thermic value. These gases are used as fuel, and the tar is merchantable; while from the pyroligneous acid are produced methyl alcohol, acetic acid, and various commercial acetates. The influence of locality is very marked in this utilization, for at some iron-works many thousand cords of wood are annually converted into charcoal—the pyroligneous acid being made into acetates and wood-alcohol; whereas at other works the wood is charred to secure the acid, the charcoal being a bye-product. Most of the wood cut for charcoal, however, is charred, and no effort is made to collect the acetic vapours. The same principle holds in regard to the manufacture of coke. As a rule, the products of distillation from the coal while being coked pass off into the air as dense smoke, and are wasted; but at a number of localities the volatile matters are condensed, and commercial ammoniates, tar, and gases of calorific value are utilized. It is claimed that, in addition to the commercial bye-products from coking ten tons of average bituminous coal, uncondensable gases equivalent in calorific value to a ton of coal result.

TECHNICAL RECORD.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Sleaford.

The Twenty-Second General Meeting of the Association was held at Sleaford last Wednesday. Everything, save the weather, was favourable to a successful day—the number of members, associates, and friends in attendance was large, the technical part of the programme was excellent, and the whole of the arrangements were planned to meet the comfort and convenience of those present. But heavy showers and threatening intervals prevented the full enjoyment of the visit. At one o'clock the party assembled at the gas-works, which for a long period have been under the management of Mr. Harry Wimhurst, the popular President, and one of the founders of the Association. An acceptable light luncheon was kindly provided by the Directors of the Company; and this was followed by an inspection of the works, which, since the last visit of the members, have been undergoing considerable reconstruction. Well ordered and splendidly kept was the unanimous comment upon the buildings and plant. Before leaving the works, the visitors were photographed; and, after this little interruption in the settled order of proceedings, they walked to the Town Hall, the use of which had been courteously placed at their disposal for the meeting by the Kesteven County Council. Among the visitors was Mr. E. H. Stevenson, the President of the Gas Institute.

During the transaction of the preliminary business, the chair was occupied by the retiring President, Mr. W. D. CHILD, of Romford.

A WELCOME.

Mr. CHILD, on taking the chair, claimed the attention of the members for Mr. H. A. PEAKE, Chairman of the Seaford Gas Company.

Mr. PEAKE said, as Chairman of the Gas Company, it was his duty to bid the Association a very hearty welcome on this occasion; and he did so with the greatest pleasure, for he recognized in the Association an organization which had been founded more for the benefit of those interested in the production of gas as shareholders and consumers than for the members themselves; and this showed how deeply all the members were interested in the profession to which they had devoted themselves. On behalf of the Company and the town, he gave them a most cordial greeting.

Mr. CHILD said the members were much gratified with the kindly reception which Mr. Peake had accorded them; and, in return, he could assure that gentleman that the members were delighted to be present to support their incoming President, who was a popular member of the Association, and had been of the greatest possible service to it. He might say that, had it not been for Mr. Wimhurst, it was doubtful whether the Association would have been in existence. He started it, and had worked thoroughly well to bring it to the position which it now held among Gas Associations. They were glad to know that the Sleaford Gas Company was represented by so efficient an Engineer as Mr. Wimhurst.

MINUTES OF LAST MEETING.

The HON. SECRETARY (Mr. J. H. Troughton, of Newmarket) read the minutes of the spring meeting at Cambridge; and they were confirmed.

NEW MEMBERS AND ASSOCIATES.

The next business on the *agenda* was the election of new members and associates. To the former class, Mr. H. Kitson, of East Dereham, and Mr. Sidney Francis, of Clacton-on-Sea, were admitted.

Mr. CHILD then read the names of the gentlemen submitted by the Committee for election to the class of associates established by the rule passed at the spring meeting. They were: Mr. H. J. Davis, Mr. John G. Glover, Mr. F. Lennard, Mr. W. J. Jenkins, Mr. J. A. Drake, and Mr. J. H. Sheldrake.

Mr. J. G. HAWKINS (Spalding) proposed the election of these gentlemen as associates.

Mr. WIMHURST remarked that the names submitted had been before the Committee, who had given them every consideration; and he had much pleasure in seconding the proposition.

The motion was unanimously agreed to.

THE NEW AND RETIRING PRESIDENTS.

Mr. CHILD said the last duty he had to perform as President was to thank the members most heartily for the kind support given to him during his year of office; and he was sure that his successor would likewise receive support and kindness from everyone during his presidency. He had pleasure in asking Mr. Wimhurst to take the chair.

The PRESIDENT, who was heartily received, said his first duty was to propose a cordial vote of thanks to their retiring President for the very able manner in which he had conducted the affairs of the Association during the past year. Connected with the Association as he (Mr. Wimhurst) had been from its birth, he knew of no President who had carried out the duties of the office with greater distinction and ability than Mr. Child. He had therefore much pleasure in proposing a vote of thanks to him.

The proposal was heartily endorsed by the members.

Mr. CHILD remarked that before he quitted the chair he availed himself of the opportunity to thank the members; for he felt sure it was rather his duty to thank them than to receive their thanks for what he had done during his term of office.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—My first duty as your President is to thank you for the honour conferred on me by electing me to the chair of this Association—a compliment I much appreciate. At the expiration of my year of office, I hope to hand the presidency over to my successor in the same satisfactory manner as our late President, Mr. W. D. Child, has handed it down to me. I accepted the position of your President knowing I should have the support of the Past-Presidents, Committee, and members generally, and knowing also that there are other gentlemen more able than myself to occupy this chair. But as I consider it the duty of each individual member of the Association to allow himself to be nominated for any office the members wish him to fill, I trust to receive the hearty co-operation of every member during my term of office, in making the work of the Association interesting, useful, and beneficial to the gas industry at large.

We may congratulate ourselves on the continued growth and prosperous condition of the business we have so much at heart, and in the interests of which we have met here to-day; and I trust each one of us will leave this meeting having learned some little lesson from the rubbing of shoulders together with his professional brethren.

You are all well aware of the greatly increased cost of our raw material during the past three years. In most cases coal has advanced as much as 2s. 9d. to 3s. per ton; and during the same period residuals have not advanced proportionately. Indeed, on the other hand, taking the average, a much lower price has been received for coke, tar, and ammoniacal liquor during the period named. It is only in the past few weeks that there has been any indication of an advance in this direction. I hope the rise will be increasingly maintained; for, as far as one can see at present, there is no possibility of coal being cheaper for a very long period, owing, I have no doubt, to the prosperous condition of the trade of this country, which we are all glad to see, and which we wish may be continued for a lengthened period. With regard to our coal supply, it has occurred to me that the combination of the coalowners has had much to do with the increased price we are called upon to pay. If this combination is good for the coalowners, why should not a similar power be set in motion to advance the prices of our residuals, by the combining of gas-works in particular districts? If such a thing could be done—and I think it could—it would be better for all concerned. We all know that coke, especially in our particular district, is sent from the larger towns into the smaller at a low rate; and this very much hampers managers of small undertakings, and prevents them getting a fair and equitable price for the coke produced. We know co-operation can do a great deal; and in this particular direction it is most desirable that we should be up and doing. One also finds combinations among the makers of other manufactured articles we have to purchase—such as meters, stoves, tubes, &c.; and if it is of benefit to the producers of these goods (of which there is very little doubt), surely a fair and reasonable combination for the sale of residuals would be most beneficial to all interested in their manufacture.

Carburetted water-gas plant is being largely introduced in this country. The causes of this, no doubt, are the ease with which a large quantity of gas can be manufactured, the increased cost of coal, the low price obtained for coke, and the small space occupied by even a large plant. As, however, we are to have a paper upon this subject to-day by Mr. Carter, I will leave it in his hands.

Vast improvement has been made in carbonizing plant during the past few years by the adoption of regenerator furnaces in the place of direct firing; and this has done much to lower the cost of production, and has secured easier and more comfortable working for the stokers. In my own case, since the putting down of regenerators of the Winstanley type, we have been enabled to work with 50 per cent. fewer retorts, and have had a greatly increased make per annum; and this with a less sum for wages. The saving in fuel has more than paid the total cost of the regenerators and settings. During 1898, my Company sold 10 cwt. 2 qrs. 23 lbs. of coke per ton of coal carbonized, after providing fuel for the steam-boiler and the blacksmith's shop. Beside this, there was a large percentage of loss by the breaking of the coke; about 40 per cent. of our manufacture being sold in this condition, and the amount of small ash being not less than 1 cwt. for every ton of coke so treated. If our works had been sufficiently large to have constructed benches of through retorts, so that one regenerator could have been employed to heat the through setting, the economy would have been very much greater.

The vexed question of stopped ascension-pipes is, to my mind, one easy of solution. If engineers and managers will be satisfied with working at not too high a heat; if they will secure a proper and even distribution of the coal on the floor of the retort; charge the retorts up to their full working capacity; prevent any car accumulating in the hydraulic mains; maintain a light seal of, say, ¾ inch; and run the exhauster at level gauge—they will, in my opinion, be able to work free from the fault alluded to above, avoid anxiety, and produce gas of fairly good quality, compatible with the quality of the coal carbonized.

Inclined retorts will now, no doubt, be more extensively used than formerly in large and medium-sized works; the patent question having been settled in favour of the gas manufacturers, although it does seem very hard upon the Company owning the patent that they should not have had an extension of time granted them, seeing they made nothing out of such a useful invention. This system, combined with charging and drawing machinery, will do much to lessen the cost of manufacture.

Condensation, washing, scrubbing, and purification, are all subjects which some of our members would do well to bring before us for discussion by means of papers at the next Spring meeting of the Association; and a further paper from our esteemed friend Mr. Shadbolt, upon his tar-enrichment process, would be most acceptable and interesting to the gas profession generally.

One of the greatest questions before us at the present time is the public lighting of our streets. Gas consumed by the flat-flame burner represented all gas could do for very many years. But the introduction of electricity in our streets and public places aroused the gas industry to a sense of its proper position in the matter; and I am glad to say it has been equal to the occasion, for now most towns of any standing have their installations of incandescent gas lighting—very much to the annoyance of the purveyors of electric current. When such towns as Liverpool, Bradford, Leeds, Bolton, and others, owning their own electrical works, use incandescent gas-burners very largely for lighting their streets and thoroughfares, the public may rest assured that they have not only adopted the best and most satisfactory system of lighting, but the most economical. Some of the provincial towns have large numbers of incandescent burners doing excellent duty in public lighting. Among them are Liverpool with 7000 burners, Sheffield 3400, Bradford 2112, Wolverhampton 1559, Ipswich 1313, Oxford 1230, Huddersfield 1000, Ramsgate 975, Dover 921, Manchester 900, Douglas 851, Maidstone 850, Eastbourne 795, Southend 552, and Winchester 500. The most singular point about the above figures is that in most of the places named the town authorities own the electrical works, where such works exist. The best installation of public lighting it has been my privilege so far to see is on the promenade at Douglas. This magnificent piece of lighting, of 1½ miles in length, is accomplished by 93 Bray lamps of the hexagon type, fitted with 3-light clusters of the No. 4 Kern and ordinary "C" burners, consuming 12 cubic feet per hour each lamp; the average candle power of each lamp being 180, or an effective lighting power, for the 1½ miles, of 16,740-candle power. There are also 27 similar lamps in other parts of the town. The whole are lighted from sunset to midnight with the three burners in use; after midnight till sunrise, one burner only is employed. This is for the three summer months; and for the remaining nine months 60 of the lamps are employed with one burner only. The cost to the town for a three years' contract is £281 12s. 6d. per annum, inclusive of all charges. The lamps are arranged in two lines, one on either side of the promenade, at distances of about 53 yards apart, and are placed in diagonal lines from the inner to the outer circle of the promenade. Any gentleman interested in public lighting would do well to inspect this piece of outdoor illumination.

In this town, the members will find the main streets fitted with improved lanterns and No. 4 incandescent Kern burners. The lighting is very effective, and is giving great satisfaction to the majority of the ratepayers. The charge is £1 18s. 6d., inclusive, per lamp per annum, of 1500 hours—a sum which, I think you will all agree, is most moderate, if not under the mark. I may add that my Company made the Council an offer to light the whole of the district in this manner, if we could be assured of a four years' contract; but as the Council have decided to promote an Order to supply electricity, they could not, in their wisdom, accept the Company's offer.

The prepayment system for gas consumers shows no sign of abatement in its popularity; the ever-increasing orders received by the makers of these meters taxing their capabilities to the utmost. In this town, as most of you are aware, we introduced the system in 1893, and have now on our books 370 prepayment, or cash, consumers. During the six years the system has been in use with us we have supplied, to the 30th of June last, 10,737,300 cubic feet of gas to this class of consumer; and the receipts, inclusive of meter and fittings rent, have been £2463 4s. 6d. They now average between £500 and £600 per annum. But for the invention of the prepayment meter, I venture to state we should never have received a tenth part of this income from new consumers of the class supplied. No doubt similar, or better, figures than the foregoing are obtained by many of you.

Gas-engines are also an ever-increasing source of revenue to the gas manufacturer. Hitherto they have only been used up to moderate sizes; but we must all be pleased to note that makers are turning their attention to engines of very much larger power. Lately, Westinghouse gas-engines of 150-horse power have been put down at Chelsea for generating electricity, and, according to the "Engineer," are running very satisfactorily; the governing of the engines being most perfect, although running at a speed of 240 revolutions per minute. I believe, however, Messrs. Crossley Bros., Limited, have made engines of even larger power than the above. It is pleasant to notice

that tramcars driven by gas power are giving great satisfaction at Blackpool, Trafford Park, Manchester, and Neath. These cars have engines of 14 brake horse power; and the consumption of gas per car-mile is about 30 cubic feet. From this source the larger towns may, in the near future, have some very large consumers of gas.

The question of interior fittings is a matter for all gas undertakings to take up, and, by the aid of a good show-room in the centre of each town, to educate the public as to what can be done for them in illumination, cooking, heating, and power, and in other directions to which gas can be so usefully and economically employed. I would suggest to each of our members (if they have not already done so) that they should supply to consumers any and every apparatus they may require for gas consumption at net cost price, including the fitting of same, and see that the goods so supplied are fitted up in the best possible manner, so as to give the most satisfactory results. An inspector told off for this special work, and to advise consumers, would repay the outlay many times over, where the works are sufficiently large to employ such a servant.

In connection with supplying fittings on hire, which most gas undertakings now do, I see the High Wycombe Gas Company have gone further, and are letting gas-engines on simple hire, or on the hire-purchase system. The Company are to be highly commended for this bold policy; and I trust they will receive the reward they so richly deserve. I think their action might well be followed by many other companies, where there is any demand for gas-engines.

The gas-consuming public will have pleasure in welcoming in the New Year the new incandescent burner and mantle of the Voelker Company, at the very moderate price of 2s. If this burner and the mantle are as perfect as the Company lead us to believe, there will be an immense field opened up for incandescent gas lighting. Surely, then, this will be the poor man's light, as also it will be the light of the more wealthy; and it will, in my opinion, prove a great check upon the purveyors of electricity.

Before closing this address, there is one matter I should like to mention—and that is the desirability of an amalgamation of the Gas Institute and the Institution of Gas Engineers. The time has now come when there should be no division in our ranks; and Associations such as this should have only one head or parent institution, and not two, as at present. I think that both of the Institutions, and all the District Associations, should send representatives to a meeting to be called by, say, the Honorary Secretaries of the Gas Institute and the Gas Institution, and let the matter be thoroughly discussed and threshed out, and a scheme prepared for the union of the two bodies. As the article in the "JOURNAL OF GAS LIGHTING" of the 5th inst. states, let the century now fast approaching its end close in peace and unity, at any rate as far as the Gas Institutions are concerned. Those who have not read the article alluded to, should do so without delay, as it will well repay perusal.

In conclusion, gentlemen, I have to thank you for your attention to the few remarks I have made; and I trust that each individual member will try and make the Association a model of what such a body should be. This can only be done by the members coming forward and contributing papers, and discussing the papers so read in a thoroughly practical manner; and I trust that my year of office will see a great improvement in this direction, and that the work of our esteemed Honorary Secretary may be made much lighter by gentlemen offering their services in the preparation and reading of papers upon subjects of interest to the profession.

"LET THE CENTURY END IN PEACE AND UNITY!"

At the close of the address,

Mr. E. H. STEVENSON said it was his pleasure to ask the members to accord to the President a hearty vote of thanks for the address he had delivered. As he listened to the address, he heard a great many interesting points, which perhaps appealed more to the members than they did to him; for, as they were well aware, he did not now personally manage a gas-works. There was, however, one point towards the end of the address which did interest him very much; and he hoped it equally interested everyone who heard it. He referred to the remarks made as to the advisability of "burying the hatchet" among the different members of the gas profession, and of there being one parent society, strong and healthy. He (Mr. Stevenson) could assure those present that he should work as strongly as he could for this purpose during his year of office as President of the Incorporated Gas Institute; and he hoped they would all work earnestly for it. He was glad to have had the opportunity of proposing this vote of thanks to the President, and trusted his wishes would be carried out in the letter and in the spirit.

Mr. R. G. SHADBOLT (Grantham) said he had been looking forward anxiously to this address of Mr. Wimhurst's. The Eastern Counties Association had a district peculiar to itself; and he thought, if they scanned the address from one end to the other, they would find it was admirably adapted to the views and requirements of the district the Association covered. It would not do for them to compare the Presidents one by one; but he did venture to say that no one could have hit off the requirements of the district better than Mr. Wimhurst had done, and no one could have been happier in the way in which he did it. He also had been struck with the latter part of the address; and he might say that he had also read the admirable leader in the "JOURNAL OF GAS LIGHTING" to which the President had referred. It appeared to him that they wanted some central authority to whip them into shape, and to bring them together. They heard a lot about two parent institutions, which was wrong—the fact of the matter being that they had one parent Institute, and an obdurate offspring. (Laughter.) He thought they could very easily, if they were only brought together, end the century in peace and unity. He had much pleasure in seconding the vote of thanks.

The motion was carried by acclamation.

The PRESIDENT said he was extremely obliged to the members. In preparing the address, he had done the best he could in the limited time at command; and for any trouble he might have bestowed upon it, he was amply repaid by the applause of the members.

Mr. J. CARTER (Lincoln) then read the following paper:—

THE RECENT COMMITTEE ON CARBURETTED WATER GAS.

The subject of the manufacture and supply of carburetted water gas has been so prominently before the members of the gas profession during recent years, that you are all more or less conversant with it. The plant necessary for its production, and the method of manufacture, have been so fully described, its cost in comparison with coal gas so carefully stated, and its advantages as well as its dangers so frequently discussed in our technical Press, at District Association meetings, and at various meetings of the Gas Institute, that probably no useful purpose would be served by making any reference (except in an incidental way) to these particular aspects of the subject at the present moment.

Recognizing the fact that carburetted water gas has come to stay, and in view of its rapidly extending use in this country, the Home Secretary, in February of last year, appointed a Committee to inquire and report on the extent to which water gas is manufactured and used, the danger attending such use, and the means to be adopted and the regulations to be imposed by which such dangers may be diminished or removed. Among the witnesses examined were gas engineers of high position (some engaged in the manufacture of carburetted water gas and coal gas, others making coal gas only) well-known scientific experts, and others who, rightly or wrongly, were doubtless perfectly sincere in the alarm with which they regarded the growth of the manufacture and supply of carburetted water gas. The Committee included scientists of the highest reputation. All the materials necessary to a complete and exhaustive inquiry into the subject were provided; and the result, as we find it embodied in the report and recommendations, is of such importance and weight as to demand universal respect.

The increasing use of carburetted water gas rendered an inquiry by some independent and central authority absolutely necessary. It had already been too long delayed. The position of the companies and corporations in possession of gas-works who desired to extend their producing power by the installation of carburetted water-gas plant, was a most unsatisfactory one. In the case of companies having unexhausted capital powers at their disposal, the directors, aware that such plant was not contemplated at the time their parliamentary powers were obtained, could not be quite satisfied that it was a legitimate use of the capital which they were authorized to raise. The position of corporations was much worse. An application for power to borrow money for the purpose of providing plant of this description, was sure to be met with a refusal. It has been suggested, however, that if the provision formed part of a large and general scheme, without a definite statement of the fact, it would be allowed to pass without any inconvenient questions being asked in relation to the matter. Such a position ought not to have been tolerated for one moment longer than the time necessary for the most comprehensive inquiry into the subject. The position I have indicated was not creditable to the central authority, and was simply intolerable to those who were placed in the control of gas-works. An industry which finds profitable employment for nearly one hundred millions of money, and for many thousands of men, ought not, in the discharge of its statutory obligations to the public, to be driven into a policy of subterfuge and suppression. Either the supply of carburetted water gas constitutes a public danger without any compensating advantages of a sufficient character to justify its adoption, or it has possibilities of public service of such an important nature that its manufacture and sale ought not to be prohibited. Upon this point, we have in the report a deliverance on the part of a most competent authority, arrived at after a full and complete investigation—a deliverance which, whether its recommendations are embodied in subsequent legislation or not, may be regarded as having closed the controversy upon the subject, as far as the public mind is concerned. If any attempt is made to legislate upon the matter, it is reasonable to suppose that the safeguards and restrictions indicated in the report represent the maximum that Parliament will be likely to impose.

The Committee have accomplished much in the direction of clearing the public mind of a misconception very generally entertained as to the character of carburetted water gas. The idea prevails that it is entirely devoid of smell; and to this fundamental error may be traced much of the opposition that exists, and almost all the objections that are urged against its

manufacture and supply. In correcting this popular mistake, the Committee have rendered useful public service. That carburetted water gas possesses a pungency of odour that renders the slightest leakage as easily detected as an escape of coal gas, is to us a matter of common knowledge; and we did not require the accumulated evidence of the several witnesses examined before the Committee to convince us of the fact. It is of such an elementary character that an apology is almost required for making special reference to it. At the same time, I am convinced that we shall have to state and re-state this fact, rudimentary as it is, over and over again, before it is generally and clearly understood by the public, and before the opposition to the development of the manufacture of carburetted water gas is finally overcome. The provision of a plant for Lincoln has been under consideration for some time; and the objection most frequently heard has been grounded upon the supposed inodorous nature of the gas. This mistake is not confined to the man in the street. Not long ago the subject of carburetted water gas was under discussion by one of our provincial councils, when the mayor, a gentleman with many years' experience of public business behind him, stated that the great objection to the gas is that it has no smell. We shall do well, therefore, to seize every opportunity of bringing to the notice of the public the following statement of the Committee upon this point: "For lighting, and in some degree also for heating, purposes it is necessary to enrich the gas with oil. In this process, which is known as carburetting, the oil is vaporized and thoroughly incorporated with the gas, thereby giving its flame luminosity, and also imparting to the gas a decided smell, similar to, and fully as noticeable as, that of ordinary coal gas. Again, an escape of carburetted water gas is as easily detected as one of coal gas, and, except in very special circumstances, can be avoided or remedied long before the atmosphere is in the least degree poisonous."

The effect of the report will doubtless be seen in a considerable increase in the number of installations of carburetted water-gas plants in various parts of the country, the probability of which was evident to the Committee, who say: "We are, however, satisfied that the advantages which many gas managers see in carburetted water gas may well lead to an increase in its use." These advantages, which were proved in the evidence of the several gentlemen who were examined, may be briefly stated as follows: Great saving in first cost of plant. Perfect control of candle power of gas made. Effective control of the coke market. Prevention of trouble from naphthalene deposits. Great saving in labour involved in manufacture. Practical independence of coal supplies during colliers' strikes and lock-outs. Prompt availability in case of emergency.

The whole of these points are invested with some measure of importance in the estimation of gas manufacturers; and several of them present considerations of great moment and value. The effect of the manufacture of carburetted water gas upon the coke supply, and, consequently, upon its market value, is a matter the importance of which may be very easily underestimated. Mr. George Livesey stated, in the course of his evidence, that the difficulty in disposing of surplus coke is the one condition that would, he thought, force the South Metropolitan Gas Company to make carburetted water gas. The improvement in the coke market effected thereby is not confined to those actually engaged in the manufacture of carburetted water gas, but is universal in its operation, and will extend to our own widely scattered district. We may have no repetition of the unpleasant experiences of former years, when in our immediate neighbourhood the market has been flooded by low-priced coke from the great towns.

The certainty of maintaining the gas supply during colliery disputes is an advantage attending the use of a carburetted water-gas plant to which I attach considerable importance. During the protracted strike or lock-out of six years ago, the purchase of coal outside of contracts cost us in Lincoln nearly £2000, and most other places usually dependent upon the Midland district proportionately as much. Most of this extraordinary expenditure, and the constant anxiety occasioned by an uncertain coal supply, which extended to the end of November in that year, would have been obviated had a water-gas plant been available. These advantages, with which we are all more or less familiar, and of which the Committee appear to have been convinced, were stated very clearly and forcibly in the evidence of such capable witnesses as Mr. A. G. Glasgow, Mr. George Livesey, Professor Vivian B. Lewes, Mr. William King, Mr. J. T. Westcott, Mr. A. C. Humphreys, Mr. Corbet Woodall, and others.

There is, however, one other consideration of a general character that is worthy of note in favour of carburetted water gas—and that is the economy in the consumption of coal that is effected in its manufacture. We are told that we are drawing upon our sources of coal supply to the extent of upwards of 200,000,000 tons yearly; and of this enormous annual tonnage 13,000,000 tons are used in the manufacture of illuminating gas. If the idea that we were taught to cherish in our youthful days—viz., that our known coal supply is practically exhaustless, and is capable of supporting this tremendous output for an indefinite series of centuries—had remained unshaken, then in that case, I admit the saving of 2,000,000 or 3,000,000 tons per year in the manufacture of gas would not be a matter of serious moment. But is this so? Mr. Forster Brown, the President of the Mining Association of Great Britain, in the course of a lecture at the Society of Arts, in April last, stated that the best of the coal resources at a moderate depth of 2000 feet, and of the best quality, cheaply worked, would last about fifty years.

To my mind, the bare fact that gentlemen of position who are qualified by their peculiar knowledge of the subject suggest that the exhaustion of our supply of cheap fuel may be within measurable distance—and that not a very remote one—is very significant indeed. The employment of any and all of the resources of science and civilization in economizing the consumption of coal assumes, in the light of this fact, an importance which is not confined within the comparatively narrow limits of the gas industry, but is a matter of national moment. It is stated in the report that "in Great Britain there is at the present time plant capable of making between 70,000,000 and 80,000,000 cubic feet of carburetted water gas per day. If this plant were worked to its full capacity every day in the year, it would produce an amount of gas equal to about 24 per cent. of all the illuminating gas supplied in the year 1897-8 in Great Britain." Assuming it reaches this proportion, then a calculation based upon 1 ton of coal yielding 10,000 cubic feet of gas and 10 cwt. of coke, available for the manufacture of, say, 30,000 cubic feet of carburetted water gas, shows a saving in the consumption of coal of nearly 2,500,000 tons per annum. Certainly, this tonnage bears no great proportion to the total annual output; but when you are dealing with a matter so vital to our industrial existence as our cheap coal supplies, and so uncertain in its duration as some of our authorities say it is, then, I think, any proposal by which economy in its use can be effected is worthy of something more than a passing thought. When the provision or otherwise of carburetted water-gas plant is under discussion, I do not say this saving should be a determining factor, but I do say it is worthy of some consideration when the probable advantages, and possible disadvantages, of an installation of this character are being weighed in the balance.

It was not, however, to learn what advantages could be claimed for carburetted water gas that I awaited this report with such deep interest. We are all well informed on these matters. They have provided material for presidential addresses at our various meetings; and the manufacturers of the plant have been most careful—and naturally so—to ensure that we shall not suffer for lack of knowledge in this particular. What I was most anxious to learn was, whether the inquiry would reveal any disadvantages of such importance as to justify any reasonable doubt as to the advisability of its adoption.

First, as to its cost in comparison with coal gas. After all, this is the standard by which the question is judged and, to a large extent, determined; and, although the Committee in their report do not discuss the economic advantages and disadvantages of water gas, in the course of the inquiry evidence was tendered relating to this aspect of the case. I need not prolong my paper by quoting the figures given in evidence, and others which have been published in our technical journals. The question of cost is largely one of locality. Gas-works situate in close proximity to rich gas-producing coals, or enjoying exceptional facilities in the way of low freights, can make coal gas at a lower cost into the holder than carburetted water gas; but in most places the latter will be the cheaper to produce. I am tempted here to ask, Why, in computing the relative cost of the two gases, do we invariably make the comparison at the holder? Do we get a fair and accurate estimate at this point? I think not. By this method we altogether omit from our calculations one charge that, in the case of carburetted water gas, is exceedingly light as compared with coal gas. I refer, of course, to the interest on capital. When capital charges are taken into our calculation of the relative cost of the two gases—as I hold they should be—then I do not think it requires any excessive boldness to state, as a matter beyond the possibility of successful contradiction, that in the great majority of the gas-works of the United Kingdom carburetted water gas can be produced at a considerably lower cost than coal gas.

Reference was made to the effect of the gas upon ordinary burners; and it was shown that some trouble was occasioned by stoppages owing to the deposit of carbon at the point of the burner, where unmixed water gas was supplied. But when it was sent out mixed with coal gas, this difficulty entirely disappeared.

We have, then, only one serious objection to consider—viz., the alleged danger attending the use of carburetted water gas, and arising from the nature and composition of the gas itself. The statements of the report may be summarized as follows:—

Coal gas contains a percentage of carbonic oxide varying from 4 to 12, according to the kind of coal used and the particular conditions of manufacture.

Carburetted water gas contains about 30 per cent. of carbonic oxide.

The poisonous action of coal gas and water gas is due solely to the carbonic oxide which they contain—that the higher the proportion of carbonic oxide, the greater is the poisonous property of the gas. This assertion was challenged; but it is stated as the unanimous opinion of the Committee.

The danger increases at a much greater ratio than the proportion of carbonic oxide.

The report states, further, that the circumstances under which

carburetted water gas may be seriously dangerous are comparatively few. In the daytime the amount of carbonic oxide is not of serious consequence; and even at night slight escapes—say, from leaky joints—are not rendered more formidable by the presence of carburetted water gas. The suspicion of the cumulative effects of the gas is dismissed with the remark: "We do not think that the existence of anything like chronic poisoning by carbonic oxide has been established."

We are told that "the prospect of any serious result from the distribution of gas containing a high proportion of carbonic oxide, is practically confined to cases of large escapes into rooms where persons are asleep." This statement possesses great interest and importance. In these few words, we have focussed the result of the inquiry into this feature of the subject. Its meaning really is that, whatever may be the scientific theories formed on the matter, in practical life the only circumstances under which serious consequences would arise from an escape of carburetted water gas are precisely those conditions which would produce equally serious results in the case of ordinary coal gas.

These excerpts fairly represent the mind of the Committee on the subject of danger. They are supported by a mass of statistics, English and American—for obvious reasons, chiefly the latter. These statistics are certainly not entitled to the importance given to them in the report. The conditions of life which provide such a fruitful contributory cause of these accidents across the water, do not exist in English towns; therefore the deductions drawn from the figures as to the probable accidents in this country, if water gas were supplied to the same extent, are entirely illusory. I have not the chemical knowledge to enable me to controvert these statements, nor the special information requisite for an effective criticism of the statistics which appear in the appendix. If I had, I should prefer to leave the matter in the hands of such authorities as Mr. A. G. Glasgow, who devoted his extremely able Gas Institute lecture to a consideration of this particular feature of the report.

Arriving at the conclusions I have quoted (the accuracy of which, for my immediate purpose, I may admit), it is only natural that the Committee should follow with the recommendations with which they conclude their report, and to which, in closing my discursive paper, I wish to draw your attention. They are, briefly, as follows:—

That it should be illegal to make and distribute any poisonous gas which does not possess a distinct and pungent smell.

That in all applications for statutory powers to make and distribute gas, the kind of gas to be so made and distributed should be stated.

That due public notice should be given of the proposal to supply any kind of water gas; and, so long as such supply continues, the fact should be stated on demand notes.

That records should be kept, where water gas is distributed, showing the respective quantities of the gases issued, distinguishing the day and night supply; and that these records should be open to inspection, and be published quarterly in a local newspaper.

That power should be conferred upon a Central Department to limit the proportion of carbonic oxide in the gas supply at night to 12 per cent., or such greater amount as the Department may consider desirable.

That power should also be given for the regulation of the distribution and use of gas, by means of bye-laws made subject to approval by a Central Department, and administered under local control. The matters to be so dealt with might include the hours during which the limit of carbonic oxide should be enforced, the extension of that limit in emergencies, the character of internal fittings, and other similar questions.

That sections 28 to 34 of the Gas-Works Clauses Act, 1871, should apply to the testing of gas for carbonic oxide, and that some person should be required to make such tests and publish the results periodically.

Some of these recommendations are not of much importance, and, if adopted, appear to me to be so entirely incapable of good or ill that we need not stay to discuss them. The fifth and sixth, however, are of great moment. They represent the principal result of the inquiry, and fix the limit to be observed in the quantity of water gas sent out in the night supply. That some restrictions should be suggested is not surprising. In deference to public feeling, which, in narrow circles, had been needlessly excited, it was, perhaps, inevitable. I do not regard it as any reflection upon the Committee to say that apparently the object of the inquiry was not so much to ascertain whether any restrictions were advisable or necessary, as to determine the extent to which they should be imposed. At the same time, the statement that I have already alluded to, that serious danger from the use of carburetted water gas is practically confined to cases of large escapes in rooms where persons are sleeping—a danger, bear in mind, as certainly existing with coal gas—it is not easy to understand how it can be removed or diminished by any limitations to be placed upon the proportion of carburetted water gas.

The question remains: Are these restrictions of such a nature as to hamper those who are now supplying the mixed gases, or give pause to those who intend so to do? I think not. The report evidently contemplates the very liberal use of carburetted water gas during the day; and it is in the daytime rather than at night that those sudden fluctuations in the consumption of gas are experienced which create the emergencies with which we have to deal, while the night limitation of carbonic oxide will admit of the distribution of (say) 25 per cent. of carburetted water gas. The proportion allowed is sufficient to meet the necessities of those whose chief purpose is to use the gas in case of emergency, and will be of great service also to those who rely upon it for a part of their normal and regular supply. The conditions set forth in the report, while they have regard to the public safety, leave ample room for the useful employment of carburetted water-gas plant upon many of the gas-works in the United Kingdom.

Discussion.

The PRESIDENT remarked that they had had a very able paper from Mr. Carter; and he would be glad if some gentleman would open the discussion.

Mr. R. G. SHADBOLT (Grantham) said they were informed from time to time that those who had had no practical experience of the manufacture of water gas had no right to speak upon it, or something to that effect. He did not know if Mr. Carter had got to work yet with his water-gas plant; if he had, he would escape the wrath of the gentlemen to whom he referred. But unfortunately for himself, he had not made water gas, except when putting out a coke heap that had fired. (Laughter.) At any rate, he had listened with interest to Mr. Carter's able paper; and he thought he might venture to say a little in the way of criticism, and, if he got his knuckles rapped, it would not much matter. The title of the paper was "The Recent Commission on Carburetted Water Gas." Now one generally looked at the title for some idea as to what he might expect before he actually read the text; but the title in this case did not indicate all that really followed. If the author had not adhered to his title in the body of the paper, he had done so in the beginning and end of the paper; and there they had to look for the drift of the work of the Water Gas Committee. The object of the Committee's work seemed to be one of the principal points that Mr. Carter intended to bring out; and it was, he (Mr. Shadbolt) took it, not so much to elucidate technicalities for gas suppliers, or to solve financial problems, as to protect the public. Whether the protection was actually required or not, had very little to do with them as gas suppliers. The public were the people they had to supply; and they had to supply them under control from head-quarters. And if the Government took it into their heads to appoint a Committee to inquire into this or that, if the public got a scare (whether rightly or wrongly), they had a perfect right to do so—not so much to hamper them in their gas manufacturing operations (that was a mere side issue) as to restrict, within safe limits, the increased proportion of a gas acknowledged to be highly dangerous if breathed. The Committee evidently recognized this, and reduced it to a question of degree. It was quite true that gas was not made to be breathed; and it was likewise perfectly true that they had to deal with defective conditions. He had waded through all the evidence laid before the Committee; and he had come to the conclusion that they fully recognized the question of degree as one of most vital importance. According to the evidence placed before them, they were quite right. This evidence proved, to their conviction at any rate, that increasing the proportion of carbonic oxide in any illuminating or other gas which might escape, increased in a greater ratio the dangerous or rather the poisonous or toxic property of the gas. He thought this was the point the Committee were aiming at; and to his mind they were quite right in going into the matter as they did. It must not be overlooked, in considering the position of the public in connection with this question, that they had, as he had already mentioned, imperfect conditions to deal with. They as gas managers might deplore this; but they must not blame the public too much if they took alarm at the increased danger. As to the danger being reduced at night time, or reducing the danger in the night period, he thought the public had every right to be protected during sleeping as during waking hours; and although the effects of carbonic oxide poisoning might not be cumulative, he failed to see that this was an argument for unnecessary exposure to an increased danger. He agreed with the author to some extent that, where water gas was of real advantage, the recommendations of the Committee put no insurmountable barrier in the way, although they curtailed somewhat the field of operations. The author had also dealt incidentally with certain "advantages" of water gas; and therefore he (Mr. Shadbolt) should not be out of order in making a few incidental remarks upon them. To his mind, the author throughout made this mistake: He assumed that water gas was, at any rate under most conditions, a *desideratum*. He failed to agree with the author. It was a very easy matter to confound advantages with claims. Claims were not of necessity advantages; and if they were advantages, it did not of necessity follow that they were so great as might be represented by those interested. Take, for instance, what was called the effective control of the coke market. In individual cases, locally, the use of water gas might have some beneficial effect on the coke market from the gas managers' point of view; but he questioned whether this effect could be said to extend universally or generally. For instance, the author

stated (and correctly, he believed) that about 30,000 cubic feet of water gas might be made from 10 cwt. of coke. Taking this as the basis, and taking the maximum capacity of the water-gas plant in use in the United Kingdom at the time the Committee sat; and if—instead of saying that, if the plant were worked to its full capacity every day in the year, it would produce an amount of gas equal to about 24 per cent. of the illuminating gas supplied—they brought it down to its normal use by dividing it by one-half, they would get 12 per cent. of the total gas made according to the Board of Trade returns instead of 24 per cent. If they commenced at this figure, and took 10 cwt. of coke as being capable of generating 30,000 cubic feet of water gas, and assumed that an average limit of one-third of water gas would be imposed, then they arrived at this: That from a ton of coal they made 10,000 cubic feet of coal gas, and added to it 5000 cubic feet of water gas; and in doing this they used 1·66 cwt. of coke. If they followed this up and applied it generally as represented by the Board of Trade returns, they brought it to this: 1·66 cwt. of coke, multiplied by the 12 per cent. of the total make, and divided by 33·33 (the one-third of water gas), equalled 0·57 cwt. That was what it practically amounted to; and it showed the difference between claims and advantages. They claimed to have an effective control of the coke market; but all they took off the market was 0·57 cwt. of the coke made per ton of coal carbonized, or 6·36 per cent. of the total coke produced. Or if they went further still, and accounted for the coke unmade through less coal being used, and taking the maximum plant that might be said to be in use in the country if fully employed under normal conditions, they then only reached the figure of 18 per cent. of the total coke made. Then it must be remembered that, if they took off the market 18 per cent. of coke which represented a certain gross quantity, someone else would put on its equivalent in coke, coal, or something else; so that they would not be conserving the world's fuel. There was thus a great difference between a claim and an actual advantage. Then, again, as to the benefits to be derived from water gas in the event of a dispute in the coal trade. If they were going to be limited to a certain percentage of carbonic oxide, they certainly would not put down a plant equal to the maximum output of gas; they would only put down a plant capable of dealing with the proportion to which they were limited. Supposing a coal strike took place similar to that to which Mr. Carter had referred, and which was going on from this period of the year right into November when they were nearly at their maximum make—however much at such a time they would like to convert their coke into water gas, the plant provided for the limited make would not be adequate. There would, of course, be a certain advantage, but not so great as originally appeared. Then coming to the saving in the consumption of coal, which Mr. Carter put at 2½ million tons a year. This on the face of it looked a big item. It certainly was a factor, though not one of prime importance. Just to show how these important factors dwindled down when placed under the microscope, he would take the figures given by Mr. Carter, and the statement of Mr. Forster Brown (whose authority on this matter one might assume to be unquestionable) that the vast coal-field referred to, under present conditions of working, had a life of only about fifty years. Then if, by utilizing the water-gas plant in the country at the present day, they saved 2½ million tons of coal a year, it would be found, by working it out, that they would only prolong the life of the coal-bed by 7½ months; so that water gas would not work such a great effect upon the life of the coal-fields. Then there came the question of the cost of water gas which Mr. Carter very properly raised. The cost ought, in his opinion, to be stated right up to the consumers' meters. Here he could not help referring, in passing, to the evidence given by Mr. Isaac Carr before the Water Gas Committee. Mr. Carr was intimately connected with the supply of cheap gas; and, in his evidence, he said that no gas authority selling gas below 2s. per 1000 cubic feet made water gas, and no gas authority in England making water gas—leaving Belfast out of the running—had, since the adoption of water gas, reduced the price of gas owing to economies effected by its use. The question, as the author rightly said, was largely one of locality; and he might have added of scope too, because there were very few gas managers in the Eastern Counties who had sufficient scope for the successful application of water-gas plant, however desirous they might be to adopt it, even if it had all the advantages claimed for it, which he contended was open to question.

Mr. W. D. Child (Romford) said he was of opinion that the discussion was something like the recent inquiry—a thing that was hardly desirable; and that it would have been better to "let a sleeping dog lie." He did not join with the author in what might be termed the censure which he had put upon the authorities who had control of the capital expenditure of gas companies, such as the Board of Trade and the Committees who dealt with these subjects in Parliament. He believed these gentlemen were so thoroughly conversant with, and so attentive to, their duty of safeguarding the public, that they would have come forward voluntarily and introduced legislation on their behalf had they believed there was the slightest necessity for doing so. He thought there was a party in the country who from an interest perhaps other than a desire to safeguard the public would lose no opportunity of pointing to the disadvantages and dangers that were likely to accrue from the use of carburetted water gas. He therefore considered they might safely rely upon it that those who had the control and the granting of powers to gas companies to put down plant of different kinds, when they saw the necessity, or thought it desirable, to interfere, would do so without being asked. He believed there were advantages to be gained by the use of carburetted water-gas plant that the public would share in; and that the time would come, and very shortly, when some of those who adopted it would be able to decrease the price of gas. Then the public would not join in the cry which had been raised to hinder the introduction of carburetted water gas, but would rather join in promoting any process by which they could be cheaply served with a good and useful supply. He did not propose to discuss the paper; and he did not think Mr. Carter intended that the question of water gas manufacture should be discussed. The author was pointing to something altogether different—that was, as to the desirability of its introduction at all.

Mr. E. H. Stevenson, on the invitation of the President, said he had a perfectly open mind on the question of water gas. He might say that he had only twice recommended it; and only one of his clients had put it in. In that case, they did not use the plant in the summer time; and the reason they gave for this was that they could not make gas by it as cheaply as they could coal gas. He could only tell the members this as a fact; and as a fact, it only bore out what was his theory—that he did not expect they would effect any saving, that the gas would probably cost them a little more, but that, in the peculiar circumstances of the place, it would save them spending a very large sum for, it might be, five or ten years. It meant an expenditure on water-gas plant of £10,000, or upon new gas-works of about £130,000. They spent £10,000 or so, and now they were going to expend £130,000; so that really they had not saved anything. If gas manufacturers were going to be limited in the quantity of water gas they could send out to the public, it would be of no assistance whatever, because in the time of a strike they could not put more than 12 or 20 per cent. of water gas* in the supply without being hauled up and fined. And, consequently, it would pay better to run short as in the ordinary way, or buy coal at an enhanced price. Therefore, he did not see in what way (except it might be for enriching purposes on large works) water-gas plant was going to be of even as much use in the future as in the past. Of course, at present they were unlimited in the amount of water gas they could turn out. He knew of one company who were making water gas to the extent of 50 per cent. of their total output; but he did not see that the price they charged was any lower than in the surrounding companies' districts, or that the price had been lowered more quickly than in the case of the others. He was quite certain, if gas manufacturers were limited to 12 per cent., water-gas plant would not be seen even as generally in the future as it was to-day. This was his firm conviction; and he certainly should not, until this question of limitation was settled, advise anybody to put in water-gas plant. Otherwise they might put it in of much too large a size for future use; and unless they could turn out a large amount of water gas a day, it would not pay, because the great saving which was always claimed for water gas was not in the cost of the oil (because oil was rather dear)—it was that one man could produce 100,000 or 500,000 cubic feet of gas per day, according to the size of his machine, instead of perhaps 30,000 or 40,000 cubic feet by other means. This was why it was claimed that there was a great saving by water gas. Otherwise it was more costly; and if they were limited, and could only turn out a small quantity of water gas, the wages would come much higher than where coal gas alone was made.

Mr. Robert Porter (Elland), called upon by the President, said he could add nothing to the discussion, or place any views before the meeting, that he had not already made public. It might be remembered that two years ago he had something to say on this matter in his presidential address to the Manchester District Institution of Gas Engineers; and he did not know that he had learnt anything from the discussion or the paper to alter his views. Mr. Shadbolt had dealt with the general question, although they were told it was not intended that the subject of Carburetted Water Gas *v.* Coal Gas should be discussed on this occasion. But as Mr. Shadbolt had "incidentally" referred to many matters, and Mr. Stevenson had given his testimony that carburetted water gas could not possibly be made cheaper than coal gas, he (Mr. Porter) thought they ought to ask Mr. Carter to qualify something which he said towards the end of the paper in reference to the cost. He distinctly told them that carburetted water gas could be made at a considerably lower cost than coal gas; but he did not seem to adduce anything in evidence. He did not show them where carburetted water gas was produced even as cheaply as coal gas. He (the speaker) ventured in his address to place before the members of the Manchester Institution and the gas world some particulars as to the cost of coal gas and carburetted water gas; and the figures had not yet been challenged. Something had been said about the price of oil; but up to the present no evidence had been forthcoming that carburetted water gas could be made as cheaply as coal gas. And he still did not think it could be.

Mr. J. A. Norcross (of Messrs. Humphreys and Glasgow) remarked that so much had been said upon the subject of

* It will be seen in Mr. Carter's reply that Mr. Stevenson corrected this statement.—Ed. J.G.L.

carburetted water gas that t seemed almost impossible to say anything new; but the author of the paper had furnished them with food for a good many hours of solid thought in the novel treatment he had given to the subject, and the many new points he had brought out. There was, however, one assumption in the paper which he did not think ought to be accepted without a great deal of reserve; and the same assumption had been made by Mr. Shadbolt and other gentlemen who had spoken on the subject. He referred to the limitation of the proportion of carburetted water gas during the nightly sleeping period. This problem must in each instance be treated in accordance with local conditions. Mr. Carter had done this, and found the limitation quite practicable in his case. He (Mr. Norcross) would venture to point out, however, that his circumstances differed in many respects from those obtaining in general. For instance, his storage facilities were ample, and his day consumption was larger than the night consumption. While at Lincoln and some other places, "limitation" could be accomplished without serious difficulty, there were in general certain objections which weighed very heavily against such a course; and especially was this so in large centres of population. First, there was the difference existing between the specific gravity of carburetted water gas and coal gas. The latter, being only about two-thirds the density of the former, presented an insuperable objection to delivering the respective gases unmixed during different periods of the twenty-four hours. This difficulty was, of course, proportionately lessened as the one gas was mixed with the other. But it was exceedingly hard to express definitely the variation of mixture that could be undertaken daily without objectionable results. He could at least say that such a variation must not exceed the equivalent of change from pure coal gas or carburetted water gas to a mixture containing 33 per cent. of the other gas. The difficulty due to specific gravity was, however, augmented by the difference in composition of the gases requiring a different admixture of air for perfect combustion. In view of the fact that the use of gas for heat and power was meeting with such wide application, this point should not be under-estimated. Secondly, it was evident that the proposed system would interfere with the use of carburetted water gas as an enricher of lean coal gas. This enrichment up to parliamentary standard was formerly effected by cannel at an additional manufacturing cost of about 2d. per candle; whereas by the use of carburetted water gas the former expense of enrichment had, in many cases, become a considerable *minus* quantity. Thirdly, the emergency value of the plant would be seriously crippled. Not only would capital investment be profitless during the "limited" period, but additional storage, &c., would be required. Fourthly, the limitation should only apply to the mixture leaving the holders; the gas management could not control the change of mixture throughout the distributing system. Trunk lines would, of course, clear themselves quickly; but gas leaving the holders during periods of light consumption would be several hours before reaching remote districts and dead-ends. Fifthly, a nightly limited period would be practical, *if at all*, only between the hours of 12 p.m. and 5 a.m. The operations of manufacture could not be suspended until the remaining productive power had well overtaken the consumption; and the plant would have to be brought into service again in advance of the heavy morning consumption by mills, &c. Sixthly, apparently sixteen was the highest percentage of carbon monoxide under consideration for the "limited" period. When he (Mr. Norcross) pointed out that the admixture of only 50 per cent. of carburetted water gas necessitated as a rule 20 per cent. of carbonic oxide in the mixture, the extent of the limitation appeared very serious. Seventhly, the pronounced tendency of gas administration in large centres of population was to concentrate all manufacturing operations in the suburban districts affording best facilities for space, labour, economical receipt of supplies, shipment of residuals, &c., and to send this gas, as produced, through independent high-pressure connections to the various distributing stations throughout the town. These distributing stations were located so as to preserve a practically constant pressure at the consumers' meters. In such cases any periodical limitation must certainly in practice prove a continual limitation. In small works possessing ample storage facilities, the operation of a "limited" system appeared feasible; but, even in such instances, he believed that it would finally be deemed entirely unnecessary. As a sign of the times, he mentioned that American extensions in carburetted water gas for the year 1898 amounted to 17 per cent. of the entire output of artificial illuminating gas in the United States; being threefold the extensions of any previous year. About 6 per cent. would cover the increased consumption during the year; consequently the remaining 11 per cent. represented further displacement of coal gas by carburetted water gas. There seemed no uncertainty in this attitude.

Mr. C. W. Grimwood (Sudbury) inquired if carburetted water-gas plant was applicable to small works.

Mr. B. B. Waller (of the Economical Gas Apparatus Construction Company) observed that Mr. Carter had examined the report of the Water-Gas Committee so very ably that there was little for him (the speaker) to comment upon. He thought some of the speakers had rather drifted from the idea of the paper in that they had brought in the question of cost; and he was inclined to think that Mr. Carter did not intend to actually deal with this point in the discussion, though, of course, it was a very important one. At the same time, he did not himself propose to touch upon it, beyond saying that he agreed with one gentleman that the cost rested almost entirely upon local conditions. In some places, carburetted water gas could be made cheaper than coal gas, and in others it could not be. It depended entirely upon local circumstances. He thought the most important point to be considered with reference to the subject of the paper—the Home Office report—was whether it was in accordance with gas engineers' ideas, and whether it should be adopted in the form in which it had been submitted. Personally, his own opinion was that it should not be adopted in that form. He thought that engineers and others who had control of gas undertakings in this country should have sufficient authority, as they had sufficient consciousness, to provide what they considered right for their consumers. It was not a question of cost; that being a matter to be considered by each individual undertaking so far as their finances were concerned. As to the advisability of the supply of water gas being entrusted to those who had the governing of the gas undertakings of this country, the welfare of the consumers was their first consideration; and it was their own welfare as well. It was therefore hardly likely, in their own interests, that they would take up a process which would be prejudicial to and jeopardize their consumers. He thought in this respect he rather differed from Mr. Carter in the latter part of his paper—that the restrictions were such as they would generally agree to. With regard to this point, it was mentioned before the Home Office Committee that the danger increased in much greater ratio than the proportion of carbon monoxide. Was not this rather theoretical? It was not what practical experience had led them to believe. If he remembered rightly, it was Dr. Haldane who propounded a theory on these lines, which he placed before the Committee. The question was, Had they any proof of the statement in this country? He did not think they need go to America for any actual proof. Carburetted water gas had been in use in this country for ten years; and this surely was long enough for them to ascertain definitely whether the danger did extend in an increasing ratio. He did not think they had any proof whatever that the danger from the use of carburetted water gas in this country since it was introduced something like ten years ago had increased one jot. With regard to the effects of carburetted water gas upon the human frame, either as a deadly or a cumulative poison, he could give a very good example, and that was Mr. Merrifield. A better specimen of humanity he had never seen. No man had spent more hours than he had on the operating floor of a carburetted water-gas plant; and he certainly did not bear out the cumulative poisoning theory, nor did he present evidence of any detrimental effect on his blood corpuscles. If there had been any, he kept it well in the background, and did not make any show of it at all. (Laughter.) He (Mr. Waller) thought Mr. Carter had introduced this paper at a very opportune time, seeing the question of carburetted water gas was being weighed in the balance, and, to all appearances at the present time, it was going to be found wanting to a greater or less extent. Those engineers who were not in favour of water gas need not take any interest in it; but to those who were in favour of it, he thought it was worth their best endeavours to see that legislation was not carried out on the lines of the limitation to 12 per cent. of carbon monoxide. The utility of a water-gas plant was most apparent in the few weeks of maximum demand, and engineers had to maintain their works to meet this maximum demand. If they could get auxiliary water-gas plant put in at about one-third the cost of coal-gas plant for use in the few weeks of maximum requirements, this would represent a considerable saving of capital, and would be exceedingly useful. During the time of maximum demand, he did not think there should be any restriction either night or day in the amount of carbon monoxide. (Laughter.) He was pleased to hear that the members generally agreed with his view on this point.

Mr. Carter, replying to the discussion, said he must express his satisfaction upon the freedom with which his production had been discussed. He was one of those who considered it was the finest compliment they could pay the author of a paper to discuss it with all the candour, freedom, and ability one could command. It was quite another thing whether the reply would be equal in capacity to the criticism. He was between two fires. He had first to defend himself against the criticisms of those who seemed to be dead against carburetted water gas—stock, lock, and barrel; and, on the other hand, against the criticisms of those who did not see any necessity for the slightest restriction either day or night. He was also placed in the unfortunate position of having to reply to criticisms which were offered in a very "incidental" way, but which extended to the second place of decimals. Mr. Shadbolt said the title of a paper should indicate something of its character; and he (Mr. Carter) thought those present were entitled to voice that criticism. He would tell the truth—he did not know what title to give it. After having carefully, and as studiously as he could, considered, for two or three years, the question of carburetted water gas with the object of putting down an installation in Lincoln, their action had been stayed by the promised inquiry—promised long before it was instituted. It therefore only seemed natural to await the result of the inquiry; and he had written the paper from the point of view of one who read the report of the inquiry with the greatest care for the determination of two things: On the one hand, whether anything transpired in the course of the investigation which would diminish

the value of the supposed advantages which had been claimed for water gas; and, on the other, whether anything occurred in its course which would so magnify the dangers that were said to be connected with water gas as to lead one to give up the idea altogether. Now he thought if members would put themselves, or try to put themselves, in his position when he sat down to write the paper, probably some of the criticisms would answer themselves. Mr. Shadbolt had made two or three statements on two or three different points, which he thought all converged to the same end—that what he (Mr. Carter) stated with regard to the control of the coke market and as to the saving in the consumption of coal by the introduction of carburetted water gas, really both resolved themselves into fractional matters in the end. But, in his opinion, Mr. Shadbolt made this cardinal mistake which was present to his (Mr. Carter's) mind when he set the figures down. Mr. Shadbolt assumed that the producing power of the carburetted water-gas plant that was in actual operation in the country a year before the investigation took place represented the maximum amount that was being produced to-day. He (the speaker) took it, having regard to the large yearly increase in the number of installations, that, if he based his calculations on the plants in active operation at the time the Committee sat, he should not be over-stating the case; and, in view of the rapid yearly increase, his figures would be under-estimated rather than in excess of the case. The decimal figures might be wrong after all as a matter of calculation; and what he (Mr. Carter) had said with regard to the quantity of coke taken off the market and the quantity of coal saved, might be, and was very likely at the present moment, far below the amount of advantage that gas manufacturers were reaping from the introduction of carburetted water gas. He still asserted that the manufacture of carburetted water gas had produced a revolution in the coke trade; and he would ask them not to imagine, because they had the present spurt of industrial prosperity (with which they were all so well satisfied and highly pleased), that to this alone was due the better prices they were able to make for their products at the present time. They might depend upon it that the manufacture of carburetted water gas had had a great deal to do with the abstraction from some of the Provincial markets of the surplus coke from the London Gas-Works. With regard to the cost of the carburetted water gas, he only mentioned it incidentally. He should not have referred to it at all, but it occurred in the course of the inquiry; and, even in the most discursive study of the report, such a subject as that could not avoid notice. He daresay all present had observed that their friend from Grantham was tightly cornered upon this matter when he wished to impress upon them that coal gas could be made cheaper than carburetted water gas. He was reduced to confining himself to one authority; but he (Mr. Carter) was not going to say anything derogatory of that friend, who occupied a position of splendid isolation. He made cheap coal gas, and sold cheap gas; and he was entitled to all the credit of his accomplishment. But there were a dozen others who were ready to say, and did say, that they made carburetted water gas cheaper than they did coal gas; and the statement published in the report—the statement of Mr. Isaac Carr, to which Mr. Shadbolt had alluded—was completely contradicted by subsequent witnesses, who said, so far from the statement being true that since the introduction of water gas no reduction had taken place in the selling price of gas, in one case the price had been reduced twice. Apart from this, he (Mr. Carter) wanted them to observe this point also, that Mr. Isaac Carr was very careful in the wording of his statement. He did not say that no reduction had been made in the selling price because carburetted water gas had been introduced. No connection was sought to be established between the two things at all. He was prepared at present—until Mr. Shadbolt favoured them with a paper (the subject would suffice for a very interesting contribution at some future meeting of the Association) giving figures very different from those he (Mr. Carter) had been able to see as the result of inquiry—to stand by the statement he had made in the paper, that at the majority of gas-works in the United Kingdom carburetted water gas could be produced more cheaply than coal gas. He did not wish to censure any public authority. His humility would always prevent him from any attempt of that sort. But it did appear to him that the attitude of the authorities was unreasonable. To stand absolutely in the way for two or three years—without consenting or without disapproving—of any movement in this direction, pending an inquiry which they were so slow to institute, naturally would create a good deal of irritation. Regarding the remark of Mr. Stevenson that the limit of 12 per cent. would seriously diminish the utility of the carburetted water-gas plant, he (Mr. Carter) did not quite understand whether his idea was that the limit was going to be 12 per cent. of carburetted water gas.

Mr. STEVENSON: I had that on my mind at the moment. I admit I was wrong.

Mr. CARTER (proceeding) said the suggestion of the Committee was that the proportion of carburetted water gas should be limited to such an extent that, in the mixed gas at night time, there should not be more than 12 per cent. of carbonic oxide, which would mean an admixture of 25 per cent. of carburetted water gas even during sleeping hours. But the point of greatest importance was this: The Committee had told them that in the daytime the proportion of carbonic oxide, or the proportion of carburetted water gas, was not of very serious consequence. Judging from the report, they would be allowed to supply as much as they liked of carburetted water gas during the day. Putting on a modest limit, they could go up to 40 or 50 per cent. during the day, and have 25 per cent. during the night. What was the effect of this on the twenty-four hours' consumption? They would be allowed—after a report like this, and after an investigation such as this—to supply water gas to the extent of from 30 to 33 per cent. of the total twenty-four hours' consumption. This brought him to the conclusion that this was a quantity sufficient to render carburetted water-gas plant of the highest utility to the gas-works of the United Kingdom. He had now to defend himself from those who saw no reason for limitation at all. It did seem to him that it was a matter of the first necessity for the Committee to take some note of the prejudices which had been created—wrongly created, if they liked. They had to reckon with and face the prejudices which existed in the public mind against the supply of carburetted water gas. It seemed to him that the Committee, in the suggestions contained in their recommendations, had taken a safe middle course. While they had had regard to the public safety, on the other hand they had evidently decided fairly as to the quantity of carburetted water gas that could be sent out from the works. As to the difficulties which Mr. Norcross suggested—difficulties in distribution arising from the differences in the specific gravity of the two gases, he (Mr. Carter) had been informed by those who were supplying the two gases that any little difficulty they had experienced was easily overcome by a slight adjustment of the initial pressure at the works. With regard to the difference in the densities of the two gases, it had been shown that a reasonable percentage of the water gas—say, up to 33⅓ per cent. of the total—caused no difficulties either with ordinary burners or with gas ovens and fires; and in this matter he thought they were justified in taking experience as their guide. As to Mr. Grimwood's question, until carburetted water-gas plant was constructed of very much smaller capacity than they had yet heard of, it did not seem at present that it would be useful on small works. But on works making (he was going to say) a million cubic feet a day down to works producing 400,000 or 500,000 feet a day in midwinter, his opinion was that there was a useful scope for carburetted water-gas plant. Whatever their opinions might be that day, he thought it was a most probable thing that, in five or ten years, they would see in this country scarcely a large works, and not many medium-sized ones, without the advantage of a carburetted water-gas plant.

The PRESIDENT remarked that they had had an able paper and an excellent discussion and reply; and he would ask that a hearty vote of thanks be given to Mr. Carter for his splendid contribution to the proceedings.

Mr. CARTER briefly acknowledged the vote.

PLACE OF NEXT MEETING.

The Committee recommended that Cambridge should again be selected for the spring meeting, as it appeared to be the most centrally situated town. On the motion of Mr. HAWKINS, the Committee's suggestion was approved.

The thanks of the members having been accorded to the County Council for the use of the Town Hall, the business proceedings terminated.

Owing to the inclemency of the weather, a drive, which had been kindly arranged by the President, had to be abandoned.

The day was brought to a close by a dinner at the Bristol Arms Hotel; the members being honoured by the presence of the Chairman and Directors of the Gas Company, and the President of the Gas Institute. The customary toasts followed.

Several of the visitors remained over the following day; and full amends were made for any disappointment felt by them at the loss of the drive on Wednesday. The weather was, in striking contrast to the preceding day, simply beautiful; and a drive of about 16 miles was indulged in. Altogether, the party numbered 24; and two brakes and a landau (for the ladies) were required. The route taken was through the villages of Kirkby-la-Thorpe, Heckington (the Queen of Lincolnshire villages), Howell, and Ewerby; thence through Haverholme Park, the seat of the Countess of Winchilsea—viewing the gardens, the priory, the deer in the park, and the river—and back to the Bristol Arms Hotel for luncheon, recreation, and tea. The party left Sleaford about seven p.m.; expressing, before their departure, their great appreciation of the liberal entertainment provided for them during the visit by the President and his Directors.

French Coke-Making.—The construction of 180 additional coke-furnaces is in contemplation in the north of France. They will produce from 160,000 tons to 170,000 tons of coke annually.

The Storage of Calcium Carbide.—The London County Council have relaxed their regulations respecting the storage of calcium carbide to the extent of permitting quantities exceeding 112 lbs. in weight to be kept in one vessel; the maximum amounts being determined by the size to which the carbide is broken. The amended regulation stipulates that no one receptacle shall have a greater capacity than 3696 cubic inches.

HERR W. VON OECHELHAEUSER ON PROGRESS IN ARTIFICIAL LIGHTING.

The Inaugural Address of the President of the German Association of Gas and Water Engineers, at the meeting at Cassel on June 19 last, has already been briefly referred to in our report of the proceedings (*ante*, p. 107). He dealt in an exhaustive manner with recent technical advances in the lighting industries; and in the sequel we give an epitome of his address, which was most warmly received by the meeting.

The fertile subject of gas supply has been so exhaustively treated in numerous communications to other and affiliated Gas Associations, that it seems desirable that the opportunity should be taken to review those questions which suggest themselves from a comparison of gas supply with other means for furnishing light, heat, and power. Such a review is particularly desirable at the present time, when specialized training is apt to make the views of the technical man very circumscribed. It is difficult for men busily engaged in one industry to estimate accurately the importance of advances in allied industries, and the relative importance of contemporaneous advances in their own industry. Therefore the allied industries of electricity supply and acetylene production will be considered, as well as the science of chemistry, which is all but inexhaustible as an auxiliary of the gas industry. Many gas engineers, however, have come to regard electricity as the ally—even if also the competitor—of gas; and the valuable time of general meetings of the Association has been partially devoted of late years to dissertations on electrical subjects.

The originator of the latest invention in electric lighting—the Nernst lamp—had, in accordance with this precedent, been asked to lecture on his discovery at this year's meeting of the Association; but unfortunately Professor Nernst was prevented from complying with the wishes of the Committee. The practical application of the Nernst lamp may, however, be contemplated by gas engineers with perfect equanimity, for it can be merely a question of cost whether it will supersede gas-burners. It offers no pretence to being a more beautiful or more convenient light than pre-existing ones, as did the Edison electric lamp at the time of its introduction; and no such æsthetic claims, the value of which cannot be rightly assessed, have therefore to be considered. The Nernst lamp is said to reduce the consumption of current by one-half, as compared with the old lamps; and, accepting this statement as correct, it will be found that gas remains far cheaper than electricity for lighting purposes. At the prices for gas and electric current which prevail in Berlin, incandescent gas-burners of good construction, used with good mantles, afford the same amount of light as the Nernst lamp at one-third to one-fourth the cost. Gas managers can therefore welcome the advent of the Nernst lamp, as they can well afford to welcome every advance in lighting; being sure the position of gas is so sound that it will not be harmed by the novelty.

Another allied industry—that of acetylene—has lost the glamour associated with its inception; but it has latterly expanded so greatly that for a time a dearth of raw material was imminent. The expansion, however, lies in new demands for light, and does not signify competition with the supply of coal gas from central works. It demonstrates afresh how great is the scope for artificial lighting.

Water gas no longer can be regarded as outside the limits of the gas industry, as in other countries, and even in various towns in Germany, it is now mixed with coal gas. In Germany enactments have so far limited the amount of water gas to 30 per cent. of the mixed gas. Recently the production of benzol on a large scale has made the conditions more favourable for the manufacture of carburetted water gas in Germany; and therefore practical results of working under these conditions may be expected at the next meeting of the Association. But the stipulations as to the quality of the gas supplied, and the difficulty which managers of gas-works have in convincing municipal authorities of the hygienic quality of a mixture of water gas and coal gas when they desire to obtain permission to erect water-gas plant, raise afresh the old question of the utility of gas of high illuminating power. So long as Welsbach burners and mantles were high in price, the supersession of flat-flame burners by them seemed unlikely; and the question was a less vital one than at present. But now, when flat-flame burners are only to be recommended for lighting in quite exceptional cases, and when, moreover, increasing gas production makes it impossible to say any longer whence and at what cost gas coals will be obtainable in the future, the question arises again with renewed force whether the old criterion of lighting value shall be retained for illuminating gas, or whether the latter shall give place gradually to more or less feebly-illuminating heating-gas, which will be capable of affording the required illuminating effect. To-day an illuminating value of at least 65 candles may be secured by means of incandescent mantles, whether the gas which affords the heating flame has an illuminating power of either 14, 10, or 8 candles in the old flat-flame or argand burner. Experiments made in the laboratory of the German Continental Gas Company throw light on the question to what extent the illuminating power determined by old methods can be reduced without injuring the illuminating effect of Welsbach mantles, and without lowering the heating value of the gas to such an extent that existing cooking and heating appliances become inefficient. The more important results of these experiments are—

1.—Reduction of the illuminating power of Dessau coal gas, tested with the batswing burner, from 13 to less than 2 candles caused an increase—not a decrease—in the candle power of the Welsbach light. The light actually rose from about 66⅔ candles to 73⅓ candles. Thus a decrease of 86 per cent. in illuminating power with the old burner was attended by an increase of 11 per cent. with the incandescent burner; the same gas being used with both burners. The absorption of benzol in the disilluminating of the coal gas caused a relative increase in the proportion of hydrogen in the gas; and the higher temperature produced by the hydrogen affords an explanation of the increase in the light from the incandescent burner. It would be gratifying if these experiments were repeated in other places.

2.—The second effect (viz., a decrease in calorific value along with the decrease in illuminating power with the flat-flame burner) was to be expected; but the change was really so small that it had no practical significance. The decrease of 86 per cent. in illuminating power was attended by a decrease at the most of 8 per cent. in calorific value. The tendency of the flame to strike-back in bunsen burners was first noticed when the illuminating power of the gas was reduced to about 4 candles, and would be avoided by an altered construction of the burners if poor gas were introduced in practice. How small the effect of a reduction in illuminating power, measured by the flat-flame burner, would be on the practical heating value of the gas, was shown by the fact that the gas of 4-candle power raised a litre of water to incipient ebullition with a consumption of only 3·7 per cent. more gas (and a similar extension of time occupied) than was needed when the gas used was about 12-candle power.

In carrying out these experiments, a small vessel packed with sawdust saturated with anthracene oil was inserted in the gas supply. The oil absorbed the benzol from the coal gas, which was thereupon tested at regular intervals both photometrically and with a Junkers' calorimeter. The results confirm afresh the view that the quality of coal gas should be that which yields the best and cheapest light, or that it should be heating gas used in the incandescent burner. To technical men it is unnecessary to say that a change to feebly-illuminating heating-gas should not be attempted suddenly, but that the time and mode of making the change should depend on local circumstances. The obligations of the contract in many towns would have to be altered. In Magdeburg, indeed, Herr Dieckmann has obtained the consent of the Municipal Council to a reduction in the illuminating power of the gas from 12·3 candles (14 Hefner units) to 8·8 candles (10 Hefner units), and subsequently to 7 candles, on condition that the incandescent burners which replace the flat-flame burners give satisfaction. Such a change in other towns will probably be rapidly made when gas coal becomes dearer and scarcer.

The incandescent system of lighting, now a cardinal feature of the gas industry, has been the subject of many gradual but great improvements. It is interesting to compare the early results obtained with the Welsbach burner with present performances, especially in view of the advent of the Nernst lamp. Observations made in the laboratory of the German Continental Gas Company enable such a comparison to be readily made. Seven years ago the speaker presented to the Association for the Advancement of Industry in Prussia the results of a series of researches. From these results, it appeared that an average illuminating value of 50 Hefner units (nearly 44 English candles) was secured for a consumption of 110 litres (3·885 cubic feet) of gas per hour. This average value is still taken as the basis of contracts and of comparisons with electric lighting, although improvements in the Welsbach and competing mantles have resulted in an *average* illuminating value of 75 to 100 units (say, 66 to 88 candles) being secured from the same gas consumption. The light obtained has been increased by 50 to 100 per cent.; and at the present time, for a correct comparison of the incandescent gas light with other systems of lighting, a consumption of only 0·04 to 0·06 cubic foot of gas per candle developed should be taken. It is, of course, assumed that mantles are obtained from good sources. Dr. Krüss and Dr. Leybold have lately reported that a mantle on which they have made observations possesses quite unexpected durability, and exhibits no falling off in illuminating power by use. The Kern burner has not yet appeared in Germany; and in many places the gas pressure would not admit of extremely high results being obtained with it. In the Dessau laboratory, it was found that a pressure of 16-10ths was required to give a duty of 1 candle per 0·04 cubic foot of gas consumed in this burner. But the gratifying fact remains that such a duty can now be secured at that pressure, whereas at the time of the Berlin Industrial Exhibition it was only obtained from gas under a pressure of 39 inches. Recent researches in the Dessau laboratory have, however, culminated in an improvement in incandescent burners by which at 10-10ths to 12-10ths pressure, and with a consumption of 3 to 3·4 cubic feet per hour, a duty of 1 candle per 0·04 cubic foot is obtained. But the use of a chimney is necessary. A larger burner, having the same efficiency, and giving a light of 162-candle power has also been produced. Further information concerning these burners will be published shortly.

Thus, while the Nernst lamp has lately effected a reduction in

the consumption of current of about 50 per cent., the improvements in burners and mantles have gradually effected an economy in incandescent gas lighting of at least equal degree, compared with the results of the system in 1892. The advantage in cost of incandescent gas lighting remains, even when the Nernst lamp is taken for comparison. In all such comparisons, it should be remembered that an average illuminating power of 66 to 88 candles must now be assigned to an incandescent gas-burner, in place of the 44 candles the old burner was credited with.

On the gas-works itself, considerable advances are being made—such as the extension of the use of mechanical conveyors, of inclined retorts, and of stoking machinery, and improvements in purification, in the extraction of naphthalene, and in the recovery of cyanogen.

In heating by gas no great new departure has lately been taken, though its use for cooking and heating continues to rapidly extend. Prepayment meters, however, seem destined to increase the consumption of gas for heating purposes; and, indeed, a rapid increase in this direction has attended their introduction in England. In Germany, they have not yet been adopted so extensively—perhaps because the immense increases in consumption in other directions have distracted the attention of gas managers from them. In the future, however, they should come into extensive use.

With regard to the use of coal gas as a source of power, its high price will prevent the extension of its employment in motors of 100-horse power and upwards for the generation of electric current. In the early days of electric lighting, makers of gas-engines devoted their energies to increasing the size of the engines. Unless gas is obtainable at not more than 1s. 5d. per 1000 cubic feet, it cannot be profitably used in very large motors. But though the limit of size for gas-engines for the consumption of coal gas appears to have been reached, there is room for extension of their use for purposes other than the production of current for electric lighting by the use of coal gas. In 1893, the speaker observed natural gas being consumed in Indiana for the production of steam for steam-engines of only 200-horse power; and he marvelled that the shrewd American people did not utilize the gas directly in gas-engines. He learns that this is now done in many parts of North America. A similar interesting and striking advance in the use of gas-engines is the employment of the relatively poor blast-furnace gas as fuel for large gas-motors. After small scale trials in England, Germany, and Belgium, the use of this gas in engines has commenced in Germany on a large scale. Blast-furnace gas, though having only one-fifth to one-sixth the calorific value of coal gas, has now very suddenly entered into competition with steam. In the last half year several installations of 500 and 1000 horse power gas-engines have been made for the utilization of this gas. But in the speaker's view, the use of such large gas-engines is by no means restricted to blast-furnace gas, but may be extended to artificial generator gas. The gas-engine should become the rival of the steam-engine up to 1500-horse power. The application of poor gases for the production of power is, however, only in its infancy; and it cannot be dealt with very fully at present. It may, however, be stated—in order to afford an impression of the economy achieved by the direct combustion of blast-furnace gas in place of its combustion under boilers—that Herr F. W. Lürmann, the blast-furnace expert, estimates that the saving for Germany alone will be equal to over £1,000,000 per annum. Even if such new departures in the employment of gas-engines seem far afield from the labour of the gas-works manager, he may pride himself on having initiated the development of the gas-motor industry, through the production of economical motors for the consumption of coal gas.

A glance at the general development of the gas industry in Germany shows that from 1826 to the present time, this year may be distinguished by the fact that more new gas-works are being constructed than in any previous year. No less than 73 new works are under construction. In 1863, there were 70; but in no other year has such a number been approached. Between 1863 and the past year there was a great lull in the erection of new works, owing to the competition with gas of petroleum and electric lighting. The advances in incandescent gas lighting have now given the gas industry a stimulus such as it never before experienced.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

The members of this Association brought their first year to a close on Saturday, the 16th inst., by visiting the Blackpool Corporation Gas-Works. The party was received by Mr. W. Chew, the Assistant-Engineer, who explained in a lucid manner the various appliances used in the manufacture of gas, and gave particulars as to the growth of the undertaking and the way in which it had been met. The most striking features of the works from the visitors' point of view were, first, apparatus for expelling the sulphuretted hydrogen from the "devil" water, to which reference was made in our report of the recent meeting of the Manchester District Institution; and, secondly, the gas-enrichment plant, also mentioned in that connection. The latter is very compact and easily controlled; and another advantage claimed for it was that, being placed on the main-pipe from the holder, the illuminating power of the gas could be increased instantly, whereas with other enriching bodies the stock of gas had to be replaced. After going through the various workshops and stores, and inspecting in the latter the large number of cookers ready to be delivered to the consumers free of charge—an arrangement which Mr. Chew said had had a good effect on the consumption of gas, and has also led to inquiries for larger stoves—the party returned to the office, where they passed a hearty vote of thanks to Mr. John Chew, the Gas Engineer, for granting them the privilege of visiting the works, and to Mr. W. Chew, for conducting them over the establishment.

The annual meeting of the Association will be held next Saturday, at their rooms at the Manchester Technical School, when the President and officers for the coming year will be chosen, the balance-sheet (which, we learn, shows a good surplus in hand) passed, and new members elected. It may be mentioned that the Association started last November with about twenty members, and the number has now been doubled. The past year's work has been very successful, and an interesting and instructive programme is being prepared for next session. The Hon. Secretary (Mr. R. T. Stoddard, of Belgrade Terrace, Cheetham) will be pleased to receive applications from anyone wishing to join the Association, and to furnish information in regard to its objects.

THE BRITISH ASSOCIATION AND WATER AND SEWAGE ANALYSIS.

Some of our readers may remember that the British Association appointed a Committee to establish a uniform system of recording the results of the chemical and bacteriological examination of water and sewage. It consisted of Professor Ramsay (Chairman), Sir W. Crookes, Professors F. Clowes, Percy F. Frankland, and R. Boyce, and Dr. Rideal (Secretary). At the meeting of the Association just closed, the Committee presented the following interim report:—

That it is desirable that results of analysis should be expressed in parts per 100,000, except in the case of dissolved gases, when these should be stated as cubic centimetres of gas at 0°C. and 760 mm. in one litre of water. This method of recording results is in accordance with that suggested by the Committee appointed in 1887 to confer with the Committee of the American Association for the Advancement of Science, with a view to forming a uniform system of recording the results of water analysis. The Committee suggest that in the case of all nitrogen compounds the results be expressed as parts of nitrogen over 100,000, including the ammonia expelled on boiling with alkaline permanganate, which should be termed albuminoid nitrogen. The nitrogen will, therefore, be returned as: (1) Ammoniacal nitrogen from free and saline ammonia. (2) Nitrous nitrogen from nitrites. (3) Nitric nitrogen from nitrates. (4) Organic nitrogen—either by Kjeldahl or by combustion, but the process used should be stated. (5) Albuminoid nitrogen. The total nitrogen of all kinds will be the sum of the first four determinations. The Committee are of opinion that the percentage of nitrogen oxidized—that is, the ratio of 2 and 3 to 1 and 4—gives sometimes a useful measure of the stage of purification of a particular sample. The purification effected by a process will be measured by the amount of oxidized nitrogen as compared with the total amount of nitrogen existing in the crude sewage. In raw sewage and in effluents containing suspended matter, it is also desirable to determine how much of the organic nitrogen is presented in the suspended matter. In sampling, the Committee suggest that the bottles should be filled nearly completely with the liquid, only a small air bubble being allowed to remain in the neck of the bottle. The time at which a sample is drawn, as well as the time at which its analysis is begun, should be noted. An effluent should be drawn to correspond as nearly as possible with the original sewage, and both it and the sewage should be taken in quantities proportional to the rate of flow when that varies—*e.g.*, in the emptying of a filter-bed. In order to avoid the multiplication of analyses, the attendant at a sewage-works (or any other person who draws the samples) might be provided with sets of 12 or 24 stoppered ¼ Winchester bottles, one of which should be filled every hour or every two hours; and on the label of each bottle the rate of flow at the time should be written. When the bottles reach the laboratory, quantities would be taken from each proportional to these rates of flow, and mixed together, by which means a fair average sample for the 24 hours would be obtained. The Committee are at present unable to suggest a method of reporting bacterial results, including incubator tests, which is likely to be acceptable to all workers.

Dr. Rideal sent the foregoing report to "The Times" for publication, and at the same time pointed out that the Committee urged the use of the system of recording the results adopted originally by the Rivers Pollution Commission, and confirmed by the Committee of the American Association for the Advancement of Science in 1887; and he said he believed it was no breach of confidence for him to add that the Royal Commission now sitting would also conform to these suggestions. A further advantage of the "parts per 100,000" over "grains per gallon" was that Continental results are always recorded in this manner. The Committee hope next year to supplement this report by further recommendations to cover the points not embodied in the present one.

REGISTER OF PATENTS.

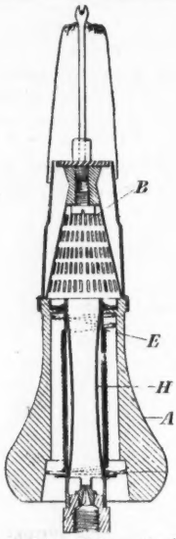
Acetylene-Generators.—Walker, W., of Aberdeen. No. 18,178; Aug. 24, 1898.

This invention relates principally to a method for regulating the water which dissolves the carbide of calcium in the generator. The gas evolved in the generator (a portion being made to act on the surface of the water under a fixed pressure in a sight-feed glass or other vessel communicating with a separate water-container) is so arranged that, when the fixed pressure is reached in the generator, it makes the water sink in the sight-feed vessel below the exit feed-pipe, and causes it to flow back into the water-container. On the flow of the water to the carbide being stopped, the surplus gas passes into the gas-container, to be used when required; and immediately the pressure is relieved by gas being used, water again rises in the feed-vessel and flows into the generator, making more gas.

Another feature of the invention is that the generators can be placed at any distance away from the gasholders; and they are so arranged that fresh charges of carbide can be supplied while the apparatus is in operation.

Anti-Vibratory Supports for Incandescent Gas-Burners.—Sachse, A. O., of Melbourne. No. 19,565; Sept. 14, 1898.

The patentee proposes to superimpose on an outer vertical cylinder the support from which the mantle depends, or alternatively the combustion portion of the burner is set upon the outer cylinder, and in its turn supports the mantle by a rod in the usual way. In the interior of the outer vertical cylinder is a vertical spiral spring, the top of which preferably extends (slightly) in diameter; while the bottom is arranged in volute form—its diameter increasing to meet the inside of the outer cylinder, and being held firmly in position by it. The main body of the spring is arranged so that it coils around the bunsen tube of the burner; the end of the tube being so placed that the mixed gases therein may flow freely and directly into the combustion portion of the burner. A is the heavy body referred to, supporting a conical perforated basket B, which forms a combustion or heating chamber, and carries the mantle at its upper extremity. It is formed with a hole, which extends through it centrally, and accommodates a sleeve or tube E, not rigidly attached to it, but enveloped by a spiral spring, the ends of which are of such a diameter as to grip the interior of the body, and thus elastically connect it with the tube. The bunsen burner-tube H fits within the tube; and it will be noticed that the bottom part of the body A extends below the openings, for the admission of air to the burner, and is recessed to allow free ingress of air to it.



Acetylene-Generators.—Waite, T. R., of Bury St. Edmunds. No. 19,683; Sept. 16, 1898.

In acetylene generating apparatus constructed according to this invention, the means provided for supplying the calcium carbide to the generating chamber consist of a hollow revolvable plug arranged at the upper end of the chamber, and having an opening formed in it, so that it may be filled with calcium carbide, and then partly revolved before its contents are discharged. In combination with the generating chamber, there is a sediment chamber arranged below, and communicating with the lower end of it through a tap or its equivalent.

Obtaining Yellow Prussiate of Potash as a Bye-Product of Coal Destructive Distillation.—Schröder, W., of Wiemelhausen, Germany. No. 19,849; Sept. 19, 1898.

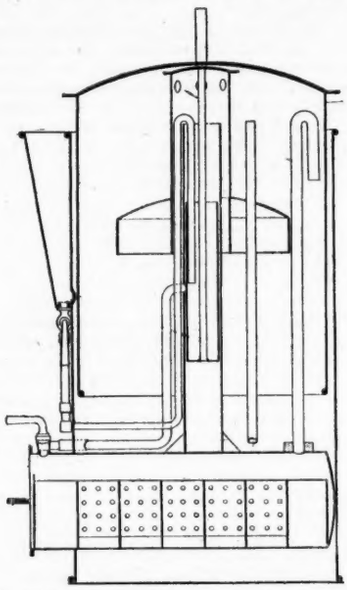
In his specification, the patentee points out that analyses have shown that gaseous products of the distillation of coal, after having been relieved of ammonia, contain 0·7 gramme of prussic acid (CNH) per cubic metre of gas, which quantity, in case it can be utilized for the manufacture of yellow prussiate, corresponds to 1·82 grammes of crystallized prussiate of potash ($K_4Fe(CN)_6 + 3\ H_2O$). Consequently, with a plant yielding 100,000 cubic metres of gas per day, the production of ferrocyanide would amount to 182 kilos. per day, or 5460 kilos. per month; and the manufacture of prussiate of potash as a bye-product of the destructive distillation of coal is therefore a great *desideratum*.

The following process has been found to answer this requirement: To the water for the absorption of ammonia, protochloride of iron ($FeCl_2$) is added before the absorption takes place. When the water takes up ammonia (NH_3), the protochloride of iron ($FeCl_2$) contained in it forms with the ammonia ferrous hydrate ($Fe(OH)_2$), besides sal-ammoniac (NH_4Cl); and with the sulphuretted hydrogen contained in the gas, it forms ferrous sulphide (FeS), which, together with the ferrous hydrate, is held in suspension by the absorption water. At the same time the prussic acid combines with ammonia to form ammonium cyanide (NH_4CN), which dissolves the suspended ferrous hydrate or ferrous sulphide, and forms ammonium ferrocyanide ($(NH_4)_4Fe(CN)_6$. If now the ammonia is distilled off, as usual, with the aid of milk of lime ($Ca(OH)_2$), calcium ferrocyanide ($Ca_2Fe(CN)_6$) remains behind; and, as the latter is sparingly soluble, a portion of it is precipitated.

For recovering the portion which has remained in solution, the gas already relieved of ammonia and prussic acid is led into the residue of the distillation containing the whole of the lime mud, in order that the carbonic acid held in the gas may precipitate the excess of caustic lime in the shape of calcium carbonate ($CaCO_3$). If now a solution of ferric chloride (Fe_2Cl_6) be added, the portion of the calcium ferrocyanide which has remained in solution separates in the shape of prussian blue ($2\ Fe_2\ 3\ Fe(CN)_6$), which rapidly forms a precipitate, together with the entire lime mud. The whole of the precipitate is then treated with a solution of potassium carbonate (K_2CO_3), while boiling and stirring, whereby calcium carbonate ($CaCO_3$) and ferric hydrate ($Fe_2(OH)_6$) are precipitated, and potassium ferrocyanide enters in solution. The solution thus obtained is boiled down, until crystals of yellow prussiate of potash ($K_4Fe(CN)_6 + 3\ H_2O$) are formed.

Acetylene-Generator.—Crees, G. W. B., of Trowbridge. No. 20,626; Sept. 30, 1898.

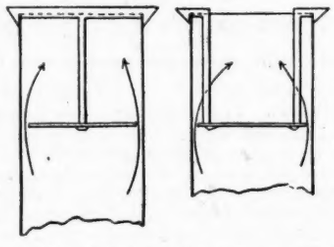
To provide for the regulation of the supply of water to the carbide of calcium in the production of acetylene, the patentee proposes to furnish a lower tank for holding water, and another inverted tank of slightly smaller dimensions, and made to rise and fall inside the water-tank, as shown in the engraving. At or near the centre of the tank is a vertical pipe, reaching slightly above the edges of the water-tank. It is open at the top, and is surrounded by the water in the tank. A smaller pipe connects this column with the carbide chambers, which are situated at the lower part of the tank; and (either on its inside or outside) a pipe leads from the inside of the column, passing over its upper edge into the



tank. The end of this pipe, which is in the column, dips into a small bucket or receptacle supported by a float resting on the surface of the water in the tank. The result is that, once the water is made to flow through the pipe leading from the tank to the bucket inside the column, the apparatus works automatically in the following manner: The gas-bell descending presses upon the float, which descends and takes the bucket inside the column down with it. As soon as the upper edge of the bucket is below the surface of the water in the tank, the water flows over the edge of the bucket, and passes into the carbide chamber. The acetylene, as evolved, is conveyed by another pipe from the carbide chambers to the gasholder, causing it to ascend; and the float, being released from the pressure of the holder, rises with it to the surface of the water. This brings the bucket with it; and immediately the edge of the bucket has reached the level of the water on the outside of the pipe, the water ceases to overflow until the holder again descends, and compels the float and bucket to descend with it. In this way, water is supplied in "the correct quantities necessary for the production of acetylene without waste."

Gas-Economizing Device for Incandescent Burners.—Shearer, M., of Old Kent Road, and Wedderburn, J. W., of Peckham, S.E. No. 8752; April 26, 1899.

This "gas-economizing device" consists of a disc or baffle made (say) of mica inserted within the burner chimney, for the purpose of regulating



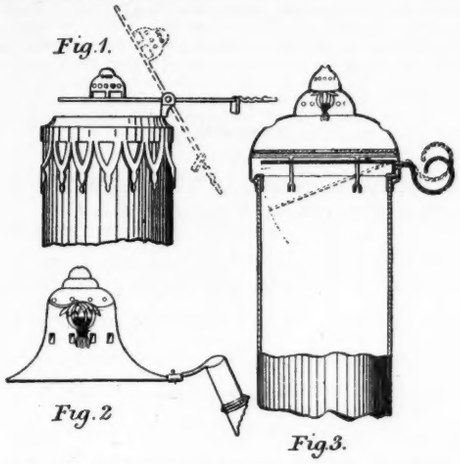
and checking the outflow of heated air from the combustion-chamber to the atmosphere, whereby it is claimed that the temperature of combustion is raised and an increased illuminating power obtained, when less than the full ordinary flow of gas is utilized.

The illustration shows sectional elevations of the top part of a chimney with the invention applied. The apertures for the escape of the heated air (whether between the disc and the glass or through the body of the disc itself) vary in area according to the pressure of gas used and the

height of the chimney; but, as a guide, it is mentioned that the best results are obtained when the area of the disc which checks the draught is from one-half to two-thirds of the area of the escape at the top of the chimney.

Automatic Gas-Igniting Apparatus.—Martini, A., of Berlin. No. 22,901; Oct. 31, 1898.

This invention relates to gas-igniting apparatus wherein the gas is lit by directing it upon a specially prepared pillule, which (on the gas impinging upon it) becomes incandescent, and thereby effects ignition. To ensure quick ignition, the patentee points out that it is necessary for the mixture of gas and air issuing from the burner chimney, when the gas is turned on, to be directed so as to impinge with some energy upon the pillule; and yet at the same time it is desirable that a small quantity of the mixture shall be retarded in its flow so as to momentarily remain in proximity to the pillule. It is also necessary that the pillule shall be so mounted that the heat evolved on its becoming incandescent shall be rapidly transmitted to the surrounding gas. The present invention therefore consists of means for mounting the pillule whereby these requirements are fulfilled, and, further, in improvements in the manufacture whereby a pillule is produced which will rapidly become incandescent upon the gas impinging upon it.

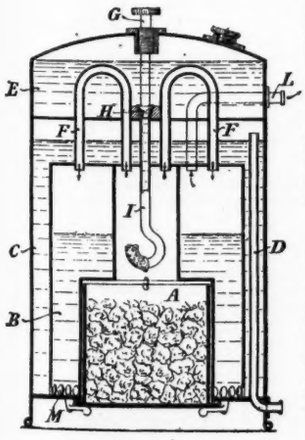


The first part of the invention is illustrated in the engraving, in which Fig. 1 shows igniting apparatus of the kind described in Patent No. 27,198 of 1898, but fitted with the improved igniting-cap; Fig. 2 shows a modification of the cap affixed to a rod; and Fig. 3 illustrates a modification of the invention wherein the cap covers the entire top of the burner chimney, but is protected from the current of hot gases by a deflecting-plate.

The inventor also claims the manufacture of igniting pillules in which the salts of the metals of the platinum group are reduced by vapours of organic acids, aldehydes, ketones, and the like, alone or combined with hydrogen, and in which the pillules may be treated with steam or ammonia and water. After repeated immersion in the salts of the metals of the platinum groups, the pillules are subjected to strong heat, so as to allow further quantities of the salts to be incorporated in them.

Generating Acetylene.—Steiner, L., of Bucharest, Roumania. No. 10,152; May 13, 1899.

The distinguishing feature of this acetylene-generator is that the carbide receptacle A is supported in the gasholder B, and can be taken out from the side or from below. The holder is surrounded by a water-tank C; the two being connected by holes M, so that the lower part of the holder contains, water. Above the water-level in the tank, one extremity of a safety-pipe D projects; the other being carried outside into the open air. The two vessels B C serve for cooling the gas and carbide; and the arrangement of the safety-pipe renders an explosion, in case of excessive production of gas, "impossible."

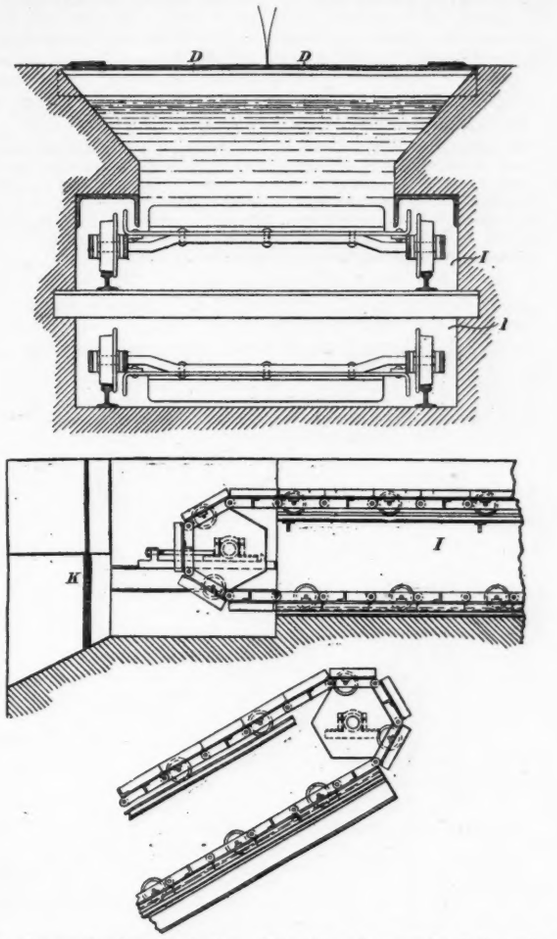


Above the vessels B C is a water-reservoir E; and by means of a valve, which can be rotated from outside through the medium of the rod G, the admission of water to the carbide on to which it drops through the pipe I is regulated. Pipes F convey the generated gas from the generator to the holder (the gas being cooled in its passage); and thence it is conveyed by pipes L to the place where it is to be consumed.

If too much gas be generated, the pressure of the gas forces the water out of the holder B into the tank C, whence it can escape through the pipe D.

Conveying Hot Coke from Retort-Houses to Stores.—Graham, M., of Leeds. No. 12,470; June 15, 1899.

The illustrations show a cross-section through the trench and the conveyor; the trailing-end arrangement; and the driving end. The improvement consists in the running of the conveyor in water contained in the trench I, provided with longitudinal hinged door-plates D. The conveyor consists of two endless pivoted bands of steel linkwork, with suitable links to which are attached pressed steel trays. In every alternate link a roller is supported on an axle bent to support and strengthen the tray. On and about every tenth plate is riveted a strong angle-iron for cleaning out



the coke smudge from the bottom of the pit, and conveying it through a sluice-valve K into a sump adjoining. The top tray and rollers are supported from the sides of the pit by T-irons, and on the return side on similar rails secured to the foundation.

The section of the trench is of the form shown; the sides and bottom being of cement slag, with channel-iron guard-plates over the wheels, and the top built over into the form of a hopper.

There is a special form of splash-plate or shield mounted on rollers, and capable of running from end to end of the bed, and of such proportions as to guide the coke into the conveyor from one bed.

The object of the sump named above is that the coke sludge conveyed by angle-irons into it may, when desired, be shut off from the main trench by the sluice-valve K, allowed to settle and drain, and after being cleaned out may be opened for further use.

Producing Solid Materials from Admixtures of Tar with other Substances.—Dörr, C., of Germersheim, Germany. No. 13,146; June 24, 1899.

This invention relates to the production of solid materials having varying hardnesses, from that of hard wood up to granite, by means of a "hitherto unknown capacity of tar to form a solid binding material when it is mixed under certain conditions with an excess of various filling materials." The use of tar with or without the addition of resin and filling materials for the covering of roofs and the like, and which mixture hardens under the action of the air, is well known; but the use of the filling material in excess for this purpose is limited by the necessity that the mixture should be somewhat fluid when it is applied. It is also, of course, known that the pitch-like residue from tar distillation, with or without the addition of bitumen and mixtures of chalk, gravel, or other finely-divided material, can be used as an artificial paving asphalt, or can be cast in moulds so as to form blocks of various shapes. In this case, the binding material in its heated condition is already somewhat fluid, and must be sufficiently so in order that, after the addition of the sand, gravel, or the like, it may be still fluid enough to be poured into moulds or otherwise poured on to the place where it is to be used—pitch only containing the heavy oils of tar, while the light oils and the medium oils have been driven off by distillation. The present invention differs from both these methods, not only in the process, but also in its products.

The claims advanced by the patentee are for a process for the production of solid bodies having hardnesses between that of wood and stone, consisting (1) in the intimate mixture of granular or otherwise finely-divided inorganic materials, such as sand, gravel, or the like, or organic materials such as sawdust or the like, with from 10 to 30 per cent. of tar; heating same to from 150° to 200° C., or thereabouts, in order to remove from the tar the more volatile of the constituents; and

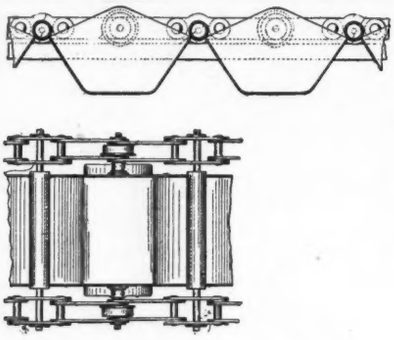
subsequently pressing or stamping the mass before it is completely cold. (2) A mixture of sand, gravel, or similar finely-divided inorganic material, with 10 to 30 per cent. of tar, boiled until the mass appears as a dry mortar. (3) A mixture of sawdust, or other finely-divided organic material, with 10 to 30 per cent. of tar, boiled until the mass appears as a dry mortar. (4) A mixture of sand, gravel, or other inorganic material, with sawdust or other organic material, and 10 to 30 per cent. of tar, boiled until the mass appears as already mentioned.

Acetylene-Generator.—Sunderland, R. H. & F., and Marshall, G., of Birmingham. No. 13,786; July 4, 1899.

This invention relates to a generator of acetylene as an amplification of the arrangement described in patent No. 6274 of 1899—see "JOURNAL" for Sept. 5, p. 600. The objects aimed at are "to improve and simplify the construction of the apparatus in such a manner that the escape of gas is prevented, the apparatus may be re-charged with carbide while in operation, the liability to explosions is minimized, and the generated gas is cooled and purified before it is conveyed to the holder."

Conveyors for Coal, Coke, &c.—Brewer, E. G.; a communication from the C. W. Hunt Company, of New York. No. 13,797; July 4, 1899.

The patentees point out that hitherto endless conveyors have been made with "a series of pivoted buckets connected by chains or wire ropes at their opposite sides; and these have been supported upon tracks by wheels or rollers, and caused to travel from one place to another, so as to transport coal or other material supplied into the buckets at one place, and delivered from the same at another place. But difficulty has been

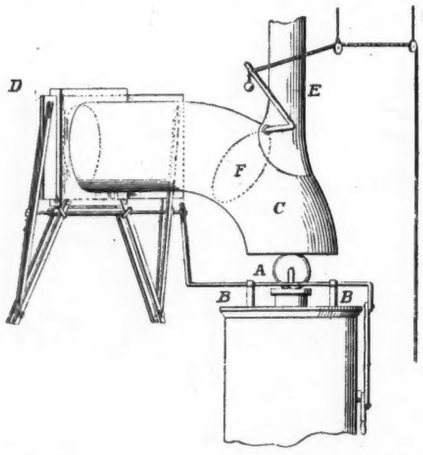


experienced in preventing the coal or other material, as it runs down from a shoot or supply, passing between one bucket and the next." To obviate this difficulty, the buckets have been made with lips lapping one over the other; but it has been necessary to change the lap of the lips so as to allow a bucket to either ascend or descend in its travel without the overlapping of the lips causing the buckets to tip.

The present invention has reference to the covering of the space between the end of one bucket and the next by an automatic shield (as shown) moved by the buckets themselves, dropping back to place and shedding the coal so that it passes into the buckets without dropping down between them. The shield is pivoted at its ends upon the endless chains or ropes, and is free to turn by contact with the edge of the bucket. In the different positions the parts assume, the shield will automatically turn or fall into position; and so the material passing down will be diverted into the buckets by the shield, and not drop down between the buckets.

Water-Gas Plant.—Hadden, J. M., of Poughkeepsie, New York, U.S.A. No. 13,888; July 5, 1899.

This invention relates more particularly to the superheater of the Lowe or other standard type of water-gas apparatus; the object of it being "to improve the construction and increase the efficiency of the



apparatus, by collecting the waste gases and other heated products of combustion, which heretofore have been allowed to escape from the superheater into the atmosphere, and conducting them to the fuel economizer, which will utilize the heat for steam-making purposes."

The superheater is provided at its upper end with a central opening closed by a valve A, carried by the lateral arms fixed on a shaft journaled in the brackets B on the upper end of the superheater. One end of the shaft terminates in a crank-arm, from which a connecting-rod extends to a hand-lever fulcrumed to the external face of the wall of the superheater. C is an elbow, the open mouth of which extends vertically above the central opening of the superheater, and its main portion forms a horizontal flue which communicates with the fuel economizer (not shown). In the valve-casing forming part of the horizontal flue, is mounted the transverse valve D, which is pivoted in the upper ends of parallel rods, which in turn are pivoted at their lower ends on the bolts fixed in the lower ends of brackets fixed to the valve-casing.

The opposite end of the shaft above the superheater terminates in a crank-arm, the free end of which is pivoted to the end of a rod so that the valves A and D may be simultaneously operated—opened or closed by the same movement of the hand-lever.

E is a smaller flue communicating with the elbow C, and in which is mounted a damper F, which may be thrown into the position shown by the dotted lines, and thereby cut off all communication between the elbow and the horizontal flue. The heated gases will thus escape through the vertical flue E. If thrown into the opposite position, across the mouth of the vertical flue, the passage will be left open for heated gases through the horizontal flue to the fuel economizer.

Heretofore, says the patentee, the large volume of heated gases which escaped from the superheater when the valve was opened, was lost by passing through the vertical flue E into the atmosphere; whereas in the present instance, the damper F being closed across the mouth of the vertical flue, when the valve A is raised, the valve D is opened, which permits the gases arising from the superheater to pass through the horizontal flue, whence they are conducted to the fuel economizer, so as to utilize the heat for steam-making purposes.

APPLICATIONS FOR LETTERS PATENT.

17,839.—FELT, W. O., "Manufacture of gas." Sept. 4.
17,843.—SUGG, W. T., "Apparatus for forcing fluids." Sept. 4.
17,888.—CHOLLAR, B. E., "Purifying gas." Sept. 5.
17,903.—FIRTH, A., and JACKSON, R., "Gas and other engines." Sept. 5.
18,065.—MASSEY, T. H., "Engines worked by gas or other fluids." Sept. 7.
18,087.—LECOMTE, A., "Chimneys for incandescent gas-burners." Sept. 7.
18,090.—YEADON, A. E. N., and WEST, J., "Washing and scrubbing gas." Sept. 7.
18,118.—MASON, J. A., "Generating gas from oil." Sept. 7.
18,159.—ADAMS, M. J., "Gas-stoves." Sept. 8.
18,189.—DEWEY, C., and CHOWN, J. A., "Generating acetylene gas." Sept. 8.
18,202.—WISE, W. L., "Overhead lamps." A communication from A. Kitson. Sept. 8.
18,204.—TRENDEL, F., "Acetylene gas-burners." Sept. 8.
18,211.—HIGGINS, H., "Utilization of combustion gases." Sept. 8.
18,237.—RYLAND, H. S., "Generation of acetylene gas." Sept. 9.
18,241.—CERVENKA, E., "Incandescent gas lamps and burners. Sept. 9.
18,259.—PUDDINGTON, A. W., "Generating and applying oxygen for effecting or promoting combustion in furnaces." Sept. 9.
18,261.—SMETHURST, W., "Production of gas." Sept. 9.
18,263.—SCHMIDT, F., "Manufacture of calcium carbide." Sept. 9.
18,285.—PRIOR, J. D., and YATES, H. J., "Gas cooking-stoves." Sept. 11.
18,302.—SARKANDER, O., and BRAUN, W., "Automatic gas-ignition apparatus." Sept. 11.
18,317.—JACKSON, J., "Supporting incandescent mantles." Sept. 11.
18,327.—OTTO, A. T., "Conveyor-belts." Sept. 11.
18,360.—BEE, J. T., "Lamplighter's lighting lamp." Sept. 12.
18,364.—ASKHAM, G. H., "Water, gas, and other taps." Sept. 12.
18,368.—CLIFFE, W., "Internal combustion engines." Sept. 12.
18,392.—HOOKER, W., "Incandescent gas-burners." Sept. 12.
18,402.—CORNWALL, E., "Gas-governors." Sept. 12.
18,418.—STUMPF, J., "Gas-engines." Sept. 12.
18,425.—SMITH, H., "Gas-engines." Sept. 12.
18,432.—THOMPSON, W. P., "Pressure-regulators." A communication from H. M. Dunlap. Sept. 12.
18,436.—HAHN, T., MÜHLENTHAL, S., and LŒWENTHAL, M., "Regulators for intermittent gas supplies." Sept. 12.
18,447.—HARRIS, A. C., "Rotary pumps and blowers." Sept. 13.
18,461.—CANOVA, A. P., and THOMPSON, W., "Acetylene gas-generators." Sept. 13.
18,466.—CRAIG, A. E. S., "Explosion engines." Sept. 13.
18,486.—MOSS, G., "Gas-lamp light sewer gas and microbe destroyer." Sept. 13.
18,513.—LISLE, H., and THE PRESTO GEAR CASE AND COMPONENTS COMPANY, "Gas cooking-stoves." Sept. 13.
18,514.—HIGGINS, H., "Utilization of combustion gases." Sept. 13.
18,556.—BRITISH PURE ACETYLENE GAS SYNDICATE, Ltd., and TALBOT, C. E., "Generating acetylene gas." Sept. 14.
18,580-1-2.—DUFF, E. J., and THE UNITED ALKALI COMPANY, Ltd., "Treatment of producer gases." Sept. 14.
18,590.—CHUBB, H. R., and BONE, G., "Generation, condensation, and storage of acetylene and other gases." Sept. 14.
18,662.—JACKSON, J., "Acetylene-burners." Sept. 15.
18,717.—MILLER, J. & D., and NOAKES, R., "Acetylene gas-lamps." Sept. 16.
18,727.—COWAN, W., "Prepayment gas-meters." Sept. 16.
18,750.—VOELKER, W. L., and THE VOELKER INCANDESCENT MANTLE, LTD., "Burners for gas lighting by incandescence." Sept. 16.

The Ashburton District Council and the Gas-Works.—The Local Government Board have given their sanction to the application of the Ashburton Urban District Council for power to borrow £3400 for the purchase of the gas-works. The period of repayment is fixed at twenty years; but the Council are seeking to get it extended to thirty.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Hastings Carburation Process.

SIR,—With reference to Mr. Young's last letter, I have to remind him that the theory of this process is not on my part under discussion, because it has not anything to do with carburetted water gas, as Mr. Young would appear to expect your readers to believe is the case. It is one thing to suggest a theory based on observed facts, and quite another to arrange facts to suit a theory. Mr. Young, I am sorry to see, evades the point raised in the concluding paragraph of my last communication, and also accuses me of making incorrect statements, which I feel sure he would not have done had he seen the carburation plant here, and therefore been quite clear as to the oil deposited in the drip-well of the carburetter, and that deposited in the syphons of the distributing mains within the area of the works.

As to the Dessau experiments and my comments thereon, Mr. Young is quite at liberty to add 8 or 17 per cent. to the cost of the oil used in the carburation process, which will still be much under the Dessau figure.

It is unfortunate, too, for Mr. Young's theory that the carburation process is now being installed in one gas-works where carburetted water gas has been made for some time past, and in two other works where water-gas plant is being erected. I feel sure that carburetted water gas is sufficiently valuable to the gas profession generally without having attributed to it virtues or attributes which it most certainly does not always possess.

CHAS. F. BOTLEY.

Hastings, Sept. 23, 1899.

Dr. Bueb's Cyanide-Recovery Process.

SIR,—Owing to a long absence from Dessau for the summer military manœuvres, I did not know of the article on "The Naphthalene Question and the Recovery of Bye-Products," published in the "JOURNAL" for the 1st ult. (p. 293); otherwise I should have taken an earlier opportunity of pointing out that the articles referred to in the "Engineer" and in the "JOURNAL" (Vol. LXIX., p. 895), were all well known to me, and that no identity exists between the Rowland process as carried on at Beckton and my process as described by me at Cassel. The "Engineer" says that in many important points my process is "absolutely identical" with that protected by Rowland. The salient feature of the Rowland process is the addition of an iron salt to the water used for filling the scrubbers or washers, the recovery of the cyanides in the form of a soluble ammonium ferrocyanide, and the working up of this compound into commercial potassium or sodium ferrocyanide. Rowland obtains, therefore, the cyanides in the liquor run off from the ordinary washer or scrubber (naturally, this liquor has only a small percentage of cyanides); while by my process the cyanides are not retained in the liquor, but are recovered in a special apparatus, before the removal of the ammonia in the scrubbers, in form of an insoluble compound. In working by my process, no gas liquor containing ferrocyanides has to be handled, but two distinct compounds—viz., cyanide mud and gas liquor; besides, the cyanide mud has a very high percentage of cyanide.

With reference to the willingness of prussiate makers to purchase the crude mud, I beg to say that this product, from which, without any worthless residuum, cyanide as well as ammonia may be manufactured, is very marketable as a raw material for making prussiate of sodium or potassium. There has been, up to now, no difficulty in disposing of this crude mud, either in Germany or in any other country where my process has been adopted.

J. BUEB.

Dessau, Sept. 22, 1899.

The Consumption of Water per Head in Different Towns.

SIR,—Some of the side-issues of this valuable correspondence are quite as interesting as the main point. For example, in the "JOURNAL" for the 19th inst., "Assistant" refers to the use of a "mica-flap" on the air inlet of a drain as if its use was recognized by the Local Government Board. And further, as he also informs us that sewer gas has a natural course, he must be labouring under the popular delusion that sewer gas from the whole length of the sewer rises towards its summit. Out of this confusion "Assistant" lifts his pen to "correct one or two of 'Student's' assertions made in the 'JOURNAL' of the 29th ult." As the way in which drainage is carried out is such an important factor in determining the amount of "the consumption of water per head in different towns," may I point out to "Assistant" that he has never found air, with a velocity of 40 feet per minute, issuing from a vent-shaft in calm warm weather. In windy weather he doubtless has; and if he has carried his experiments far enough, he has also found that not only will the air issue from the vent-outlet, but that the reverse of this often occurs—viz., that the wind will blow down this pipe, and, when pent up by the "mica-flap," it will often unseal the disconnecting trap or some other trap.

As "the wind bloweth where it listeth," and operates differently from nearly every quarter, I will not refer to it any further, but will ask "Assistant" to tell us how his experiments worked out on a calm day similar to those we have had nearly all the past summer, when complaints of drain and sewer smells have been so numerous, when the temperature of the outer air has ranged from 53° to 85° Fahr. in the shade during the twenty-four hours of each day, and the drain air or sewer air ranged in the same period from 55° to 59° Fahr., or a difference of only 4° in the drain or sewer as against 32° in the outer air.

"Assistant" says: "I am afraid the experience of the householder that a half-inch tap will cause the sewer gas to change its natural course, is somewhat peculiar." Will "Assistant" kindly tell us what the natural course of sewer gas is? I would just point out to him that, from inquiries made in different towns, it is found that notwithstanding the regulations of the Local Government Board, in 50 per cent. of the towns which have adopted the "model bye-laws," they are not putting in disconnecting traps; also that in many towns the intercepting traps which have been fixed are now being taken out. The City Surveyor of Lincoln says that 90 per cent. of the houses in the city are not disconnected from the sewers. Another Surveyor says that not 2 per cent. of the houses in his town are disconnected from the sewers.

STUDENT.

Sept. 21, 1899.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Wednesday, Aug. 2.

(*Before the* MASTER OF THE ROLLS, *Sir* F. JEUNE, *and Lord Justice* ROMER.

In re The National Bank of Wales, Limited.

This was an appeal from a judgment of Mr. Justice Wright, given on the 7th of December last, upon a misfeasance summons issued against Mr. John Cory by the Liquidator of the National Bank of Wales. The facts and the following extracts from the judgment of the Superior Court are taken from the report in "The Times" on the 3rd ult.; and are now given in connection with an article in our editorial columns to-day.

In February, 1893, an agreement was entered upon between the National Bank of Wales and the Metropolitan Bank of England and Wales, whereby, upon the shareholders of the former bank voluntarily winding up its affairs, the Metropolitan Bank took over the assets and goodwill (other than the uncalled capital) of the National Bank, and undertook to satisfy its liabilities. It was, however, provided that should the assets prove of less value than the liabilities, the National Bank or its liquidators should call up sufficient of the uncalled capital to meet the deficiency. In the result there was found to be such a deficiency amounting to £41,000. The Liquidator of the National Bank, thereupon, before making a call upon the shareholders, issued a summons against Mr. John Cory, a former Director of the Bank, asking for a declaration that he, as Director, had been guilty of misfeasance or breach of trust (1) in authorizing, sanctioning, or participating in, the payment to shareholders of interest or dividends upon their shares out of the capital of the Company, and was liable, and might be ordered, to pay to the Liquidator the amount so paid during the period in which he acted as Director; (2) in sanctioning improper advances out of the funds of the Bank, whereby a loss accrued to the Company, and that he might be ordered to pay to the Liquidator the amount of that loss; and (3) in sanctioning improper advances to customers, and allowing debts of customers to continue, knowing that those customers were unable to pay the amount of their indebtedness, and that he might be ordered to pay to the Liquidator the amount of the resulting loss to the Bank. Mr. Justice Wright held that only the first claim had been established, and accordingly ordered Mr. Cory to pay to the Liquidator a sum amounting, with 5 per cent. interest, to £54,000. Mr. Cory appealed. The Liquidator entered a cross-appeal, in respect of claims 2 and 3, asking that, for the purpose of ascertaining the liability of Mr. Cory, the whole period during which he acted as Director might be considered, notwithstanding that six years might have elapsed from the commencement thereof, on the ground that the losses arising from the wrongful acts before stated, and the true condition of affairs of the Company, were fraudulently concealed by him; that he issued balance-sheets that were to his knowledge false; and, moreover, that part of the interest and dividends wrongfully paid were retained by him, and converted to his own use, as a shareholder. The Court allowed the appeal, and dismissed the cross-appeal.

The Master of the Rolls read the judgment of the Court. After stating the order appealed from, and the grounds alleged in the cross-appeal, his Lordship continued: The appeal and cross-appeal thus require the Court to examine into Mr. John Cory's conduct as a Director of this Company from the time when he became a Director, in 1884, until he ceased to be so, in December, 1890, or even later if the Liquidator be correct. The order under review was made on a summons issued, under section 10 of the Companies (Winding-up) Act, 1890, on June 14, 1895—a date which is material, having regard to the Statute of Limitations on which Mr. Cory relies as a defence to the greater part of the demands made against him. It will be convenient to consider his appeal first. This raises the question whether the funds of the Company have been misapplied in payment of dividends; and, if they have, then whether Mr. John Cory is liable for that misapplication. Before examining the controverted facts, and discussing the legal questions which arise, it is desirable to state shortly the history of the Company, and how the present controversy arose. The National Bank of Wales was a limited Banking Company formed in 1879. . . . Its capital was £2,000,000. . . . In 1884, the paid-up capital amounted to £125,000, and so remained until 1890, when it was increased to £225,000. . . . The Company's principal bank and its head office were at Cardiff, where the Directors met and the General Manager was in daily attendance. The Company had also many branch banks, each with its own Manager. The course of business was this: Each Branch Manager sent weekly to the head office a "weekly state"—*i.e.*, an account showing how the assets and liabilities of the branch stood, what advances or overdrafts had been made or allowed, and to whom, what securities the bank held, and other matters. Every quarter each Branch Manager made a more formal return to the head office, shewing the position of the branch and the business done during the past quarter. It was the duty of the General Manager to examine these documents, and to report to the Board anything disclosed by them which required their attention. The weekly states and quarterly returns were in the board-room for reference in case of need; but, unless attention was called to them, the Directors did not think it necessary to examine them. The Chairman of the Directors was Mr. Thomas Cory, a brother of Mr. John Cory. The Chairman and the General Manager, Mr. Collins, visited each branch bank every year; and, in addition, two skilled inspectors frequently went round, inspected the accounts, and reported to the General Manager. The accounts of the branch banks appear, however, not to have been separately audited by professional accountants. The Auditors employed to examine the Company's accounts, and to certify the annual balance-sheets and accounts laid before the shareholders, only saw the head office books and the returns from the branch offices, certified by their respective Managers, to the head office. These certified returns formed part of the "weekly states," but omitted much that they contained.

The minutes of the Directors' meetings show that, speaking generally, they attended with reasonable regularity and transacted a large amount of business. No Director, unless it were the Chairman, attended to any details not brought before the Board either by the Chairman or by the General Manager. Mr. John Cory has stated in his affidavit the general course of business at board meetings; and his cross-examination

does not substantially differ from the account he there gives. Mr. Justice Wright has regarded this evidence as an admission by Mr. Cory of a total abnegation of the use of his faculties, and of an entire neglect of his duties. We cannot go so far as that. His evidence does, however, show that he only attended, when present, to whatever his attention was called to; and that, having no suspicion that anything was wrong, he made no special inquiries in order to ascertain that all was right.

After Mr. John Cory had ceased to be a Director, the Company made large advances on insufficient security, and took over an insolvent business which greatly embarrassed it. The Company, however, was not unable to pay its debts, for its large uncalled capital was amply sufficient for that purpose; and, so far as its outside liabilities are concerned, it always has been, and is, quite able to discharge them in full. Being, however, in difficulties, the National Bank determined to amalgamate with another Company, and to wind up. Having given the terms of the amalgamation, his Lordship, referring to the ascertained deficiency of £41,000, for which the National Bank are liable, proceeded to say: The sum can be raised easily enough by a call on the shareholders; but they naturally object to this if money can be got in, from other quarters, which will relieve them from the necessity of paying a call. The investigation into the affairs of the Bank, which has been made in order to carry out this amalgamation with the Metropolitan Bank, has revealed a very unsatisfactory state of things. The whole of the paid-up capital has been lost, and some £41,000 has to be raised to clear it from debt. The loss is to a large extent attributable to the fact that a large number of debts due to the Bank by its customers have turned out to be bad, and that large sums advanced to Directors, and owing by them, are irrecoverable. Moreover, large dividends have been paid for a number of years as if the Bank were flourishing; while, in truth, if its affairs had been properly conducted, the large dividends declared and paid ought never to have been recommended by the Directors.

There can be no doubt that the shareholders were grievously deceived by the reports and balance-sheets laid before them; and no one can be surprised at their anger with the Directors, and especially with the Chairman and the General Manager—both of whom have been criminally prosecuted and convicted for their fraudulent conduct. Mr. John Cory's answer, however, to the attempt to make him liable for the losses sustained and dividends paid while he was a Director, is that he was himself as much deceived as the shareholders by the Chairman and Manager, and that he was not guilty of any breach of his duty in not making special investigation when he had no reason to suppose that anything was wrong. Mr. Justice Wright came to the conclusion that Mr. Cory was not only negligent but fraudulent, or, at all events, guilty of misconduct equivalent to fraud as regards its legal consequences. The learned Judge came to this conclusion from the fact that in their reports the Directors unjustifiably stated that they had made provision for bad and doubtful debts, whereas they had not. That the Chairman and Manager knew this, is very likely true; but that Mr. John Cory knew it, is quite another matter. The table of bad debts shows that sums were constantly written off for bad debts, and there is nothing to justify the inference that Mr. Cory knew that these sums were insufficient, or that he did not honestly believe them to be sufficient. It may be that he ought to have been more vigilant than he was, and that he should not have trusted his brother and Collins so much as he did. But negligence is one thing, fraud another; and we are quite unable to adopt Mr. Justice Wright's view that Mr. John Cory acted fraudulently in making reports to the shareholders and laying the balance-sheets before them. . . . The charge of fraud against Mr. Cory has failed. . . . This is not only a very important matter to him as regards character, but—to a great extent—relieves him from responsibility for anything done or omitted before June 14, 1889.

Another part of the case in which we are unable to agree with Mr. Justice Wright relates to the date of Mr. John Cory's retirement from the Board. . . . In the view of the Court below, Mr. Cory improperly allowed his retirement to be concealed, and allowed himself to be held out as a continuing Director and as concurring in the report of January, 1891, which the learned Judge holds to be as fraudulent on Mr. Cory's part as those which preceded it. We cannot accept that view of this part of the case. We are satisfied that Mr. Cory's resignation (on Dec. 18, 1890) was *bonâ fide* and a fact—not a sham. . . .

With these preliminary observations, we pass to consider Mr. John Cory's liability in respect of the dividends declared in July and December, 1889, and July, 1890. The Liquidator has taken the view that the dividends declared and paid by the Company when Mr. Cory was a Director were all paid out of the capital of the Company; and the evidence adduced by the Liquidator is directed to prove that such was the case. But, when this evidence is examined, it seems quite plain that the dividends were not, in fact, paid out of any part of the money forming the paid-up nominal capital of the Company, but were paid notwithstanding the loss of that capital, and without making it good. What was done was this: The accounts were made up annually. Such losses incurred during the year as the Directors recognized as losses were written off or provided for by carrying sums of money over to a reserve fund; and the balance of the receipts in each year over the outgoings in the same year—after making some allowance for bad debts and deductions for sums carried over to the reserve fund—were treated as the profits of the year, and were divided as dividends. Losses written off in one year were not brought forward the next year, so as to diminish the profits of that year, but were simply ignored—a fresh start being made every year, and dividends being paid out of the excess of the annual receipts over the annual expenses. The effect of this was to throw all bad debts written off and not provided for by an increase of reserve fund on the capital, and to diminish the paid-up capital year by year, and nevertheless to keep paying dividends out of the excess of the annual receipts over the annual expenses. It is obvious that this method of procedure, if long continued, would ultimately exhaust the paid-up capital of the Company; and the first disastrous year in which the current outgoings exceeded the current incomings, would produce great embarrassments. Such a mode of dealing with the Company's assets, however reprehensible, must, nevertheless, not be confounded with paying dividends out of the paid-up capital of the Company. The paid-up capital of a limited company cannot be lawfully returned to the shareholders under the guise of dividends or otherwise. . . . But paid-up capital which is lost can no more be applied in paying dividends than in paying debts. Its loss renders any subsequent application of it impossible. There was no such dealing with the paid-up capital of the Company in this case as to amount to an illegal application of it.

Further, it is not possible for the Court to say that the law prohibits a limited company—even a limited banking company—from paying dividends unless its paid-up capital is intact. Suppose a heavy unexpected loss be sustained. It must be met if there be assets wherewith to meet it. The capital—even uncalled capital—must, if necessary, be applied to meet it. Such an application of capital is a perfectly legitimate use of it. There is no law which, in the case supposed, prevents the payment of all future dividends until all the capital so expended is made good. Many honest and prudent men of business would replace a large loss of capital by degrees, and reduce the dividends, but not stop them entirely, until the whole loss was made good. No law compels them to pay none at all. There are cases in which no honest competent man of business would think of charging particular debts or expenses to capital. We are certainly not prepared to sanction the notion that all debts incurred in carrying on a business can be properly permanently charged to capital, and that the excess of receipts over the other outgoings can be afterwards properly divided as profit, as if there had been no previous loss. No honest, competent man engaged in trade or commerce would carry on business on such a principle. But, excluding cases in which everyone can see that a particular debt or outlay cannot reasonably be charged to capital, it may be safely said that what loss can be properly charged to capital, and what to income, is a matter for business men to determine, and is often a matter on which opinions of honest and competent men differ. There is no hard-and-fast legal rule on the subject. There can, however, be no doubt that if expenses or payments are obviously improperly charged to capital, and are so charged simply to swell the apparent profits, and to make it appear that dividends may be properly declared, dividends declared and paid under such circumstances cannot be treated as legitimately paid out of profits, and can no more be justified than if they were paid out of capital. . . . Sir G. Jessel inclined to the opinion that a limited company could not pay dividends unless its paid-up capital was kept up. But no decision has yet gone this length; and it has since been decided that dividends may be paid, even by a limited company, although the nominal capital be not kept up. . . . In the case of *Lee v. Neuchatel Asphalte Company*, what was lost was fixed capital; and it is obvious that circulating capital or any other money employed in earning returns must be deducted from them in order to ascertain how much of them can be regarded as profit. If the returns do not exceed the money spent in procuring them—whether that money be called circulating capital or any other name—there can be no profits, and no ingenious process of book-keeping can alter the fact. It is not denied in this case that the annual receipts did exceed the annual outgoings; and the dividends having been paid out of the excess, the allegation that they were paid out of capital is consequently not accurate. But, as already pointed out, it does not at all follow that the course adopted by the Directors, in declaring dividends year after year as they did, was legally justifiable. It cannot be denied that the balance-sheets and profit and loss accounts concealed the truth (as now known) from the shareholders, and were, as it turns out, grievously misleading. The shareholders were never told that the paid-up capital was being continuously diminished by bad debts, as now appears to have been the case. The shareholders were told every year that proper provision was made for those debts; and now that the case has been thoroughly investigated, it is really reduced to the question whether Mr. John Cory was justified in making the statements he did, and in dealing as he did with debts which have now been ascertained to be bad.

It is easy to be wise after the event, and there is danger in treating a Director as knowing years ago what now appears to be the fact. But it is the duty of the Court to examine the state of things as they appeared to him when the dividends were declared; and to determine whether he was justified in what he did by what he knew and ought to have known. What he ought to have known is as important as what he knew. It was stated in a judgment delivered in this Court in the *Lagunas* case (reported in "The Times" of June 27 last) that if Directors act within their powers, if they act with such care as is reasonably to be expected of them, having regard to their knowledge and experience, and if they act honestly for the benefit of the Company they represent, they discharge their equitable, as well as their legal, duty to that Company. We believe this statement of the law to be correct, and we adopt it as our guide.

It has been shown that in this case the dividends did not, in fact, come out of the paid-up capital of the Company. Fraud is not established against Mr. Cory; nor is there any proof that he was acting in the interests of his own friends, or of himself, and not *bonâ fide* with a view to the interests of the National Bank. The inquiry, therefore, so far as he is concerned, is reduced to the representations he made as to the position of the Company, and of his alleged want of care and attention to the affairs of the Bank, and more particularly to his omission to find out that the Manager was misleading the Directors. In the *Lagunas* case, it was said, and we repeat, that the amount of care to be taken is difficult to define; but it is plain that Directors are not liable for all the mistakes they may make, although if they had taken more care they might have avoided them. (See *Overend, Gurney, and Co. v. Gibb.*) Their negligence must be not merely the omission to take all possible care. It must be much more blameable than that; it must be, in a business sense, culpable or gross.

His Lordship proceeded to point out that in respect of bad debts certain, though not sufficient, provision was from time to time made by the Directors, and that Mr. John Cory really believed that the provision so made was ample. He then continued: The question then arises, Was it his duty to test the accuracy or completeness of what he was told by the General Manager and the Managing Director? This is a question on which opinions may differ; but we are not prepared to say that he failed in his legal duty. Business cannot be carried on upon principles of distrust. Men in responsible positions must be trusted by those above them as well as by those below them, until there is reason to distrust them. We agree that care and prudence do not involve distrust; but for a Director acting honestly himself to be held legally liable for negligence in trusting the officers under him not to conceal from him what they ought to report to him, appears to us to be laying too heavy a burden on honest business men. But this is the whole of Mr. John

Cory's shortcoming as proved by the evidence. . . . . It must be now conceded that if he had himself studied the weekly statements and quarterly returns, and had compared those for one period with those for another, and more especially if he had seen the letters addressed by the Auditors to the Directors, he would have been put upon inquiry, and would have found out—if he had not neglected his duty—that the affairs of the Bank were not in the flourishing condition in which he believed them to be.

The existence of the letters written by the Auditors, and accompanying their certificates, was very much relied on against Mr. Cory. Those letters are not produced. They were never found by the Liquidator. His knowledge of them is derived from copies furnished by the Auditors. These letters warned the Directors annually, in and after 1884, and especially in January, 1890, that there were matters which required investigation; and if Mr. Cory had known or suspected that there were such letters, and he had omitted to make inquiries into the matters to which attention was drawn, he would plainly have neglected his duty as a Director, and have been guilty of negligence to the degree justifying the epithet "gross." But he had no reason to suppose there were any such letters; and, apart from them, the Auditors' reports justified him in supposing that all was right. The letter from the Auditors of Jan. 13, 1890, to the Secretary of the Bank was answered by the Secretary on Feb. 13, 1890; it had been laid before the Board on the 10th, but Mr. Cory was not there. He was, apparently, present at a subsequent meeting at which the minutes of the meeting on the 10th were confirmed; but the matter did not attract his attention, and, considering the terms of the minutes, this was very natural. We are satisfied that these letters from the Auditors were fraudulently concealed from Mr. Cory, and that he never knew of, nor suspected, their existence. His ignorance of them was not attributable to negligence on his part.

Mr. Cory's omission to examine the weekly and quarterly returns is also, we think, excusable—though not on the same grounds, for they were known to exist, and were in the board-room for inspection. We have had the advantage of an exhaustive examination of them, and of a comparison of a long series of them; and we know the result and their full significance. But without a comparison of those for one period with those of an earlier period, a Director would derive little information that was really useful. No suspicion being aroused, Mr. Cory's reasons for not examining them are natural; and his omission to examine them does not show want of reasonable care and attention on his part to the affairs of the Bank. He had no reason to suppose that there were unsatisfactory debts beyond those written off and provided for. The evidence, when carefully sifted, unquestionably shows that Mr. Cory might have found out that he was deceived by the General Manager, and that the dividends declared were not, in a business sense, warranted by the profits made. On the other hand, the evidence shows that although he was deceived he neither knew nor suspected it. We are not prepared to say that he was guilty of any breach of duty in not discovering that those whom he trusted were misleading him; nor that, in point of law, he was guilty of any breach of duty in recommending the payment of dividends as and when he did. A Director does not warrant the truth of his statements—he is not an insurer. But if he make misstatements to his shareholders, he is liable for the consequences, unless he can show that he made them honestly, believing them to be true, and took such care to ascertain the truth as was reasonable at the time. This, we think, Mr. Cory did. It therefore follows that he is not only not liable to make good the dividends declared, but also that he is not liable to refund those which he himself received as a shareholder, whether before or after June 14, 1889, for there was no breach of trust in this matter by him.

In regard to the advances made to Directors without security, his Lordship related the facts, and pointed out that the securities were never reported to the Board as insufficient, and that Mr. Cory neither knew nor suspected that they were so. His cross-examination on these matters showed that many material facts were concealed from him. As to the question whether he ought not to have been more vigilant, the previous observations of the Court again applied. His liability for omission to find out the facts had already been considered and negatived.

Lastly, said the Master of the Rolls, we think it only due to the Liquidator to add that, although Mr. Cory has succeeded in his appeal, his conduct justified the closest scrutiny. But the order appealed from ought to be reversed; and, having regard to the serious charges made against him, the Liquidator must pay Mr. Cory his costs, both of the summons and of his appeal.

Claim in Regard to the "Gassing" Fatality at Bury.

His Honour Judge Jones, sitting at Bury, last Wednesday, as arbitrator under the Workmen's Compensation Act, had before him a claim brought by Margaret Lee, widow, against the Bury Corporation, to recover compensation for the death of her husband, John Lee, who was employed at the gas-works. Mr. Cobbett, Manchester, appeared for the applicant; Mr. Langden represented the Corporation. At the opening of the case, Mr. Langden said the Corporation had arrived at the amount which the applicant would be entitled to, assuming that the Corporation's liability was satisfactorily made out. This amount was £247 11s. 7d. The facts of the case, as detailed by Mr. Cobbett, were that deceased was employed as a sulphate maker, and part of his work was to break down the walls of the sulphur kiln when anything seemed to be going wrong. On the 4th of January last, Lee went to the kiln at about eight o'clock in the morning—for what purpose was not known—and a few minutes later he was found lying on a heap of ashes, some distance from the kiln, unconscious, whilst a hole had been made in the brickwork. Lee never recovered consciousness, and died in about half an hour. Mr. Cobbett added that it was suggested in the pleadings for the defence that the Workmen's Compensation Act did not apply in this case, and another defence was that the claim had not been made within six months of the accident. Mr. Langden said this point had been abandoned. Mr. Cobbett then dealt with the question as to whether the deceased's employment came within the scope of the Act, and argued that under the Act the word "factory" meant the same as it did under the Factory and Workshops Act. Under that Act, a "factory" was defined as a place in which manual labour was exercised by way of trade for purposes of gain. At the gas-works, manual labour was employed by way of trade for purposes of gain; and, in addition, there was a small steam-engine close to this place, which was used in connection with the treatment of the bye-products of gas. Beyond that, the Inspector of Factories visited the place in the discharge of his duties. It was further asserted for the defence that the injury to the deceased did not arise out of, or in the course of, his employment. The case he had to put before his Honour would, he thought, satisfy that objection. A part of this man's duty was to open the kiln when it was required, and there would be evidence to show that this accident arose during the course of his employment. Mr. Langden said he did not admit that it was part of Lee's duty in any way to open the sulphate-house or kiln. Mr. Cobbett said he should not be able to prove that Lee opened the house; but there was evidence that he was found lying outside it, that some of the bricks had been taken out, and that suffocation was the cause of death. It would be for the defence to prove that it was due to his wilful misconduct that the man came by his death. Evidence having been given as to the facts of the case, Mr. Langden said the Corporation had not entered lightly into this litigation, and they had done so mainly because they did not want to be held responsible for the death of a workman who deliberately, and in direct contravention of the rules of the works, went into danger. Lee had no business to go to the sulphur-kiln alone on this occasion, and, therefore, the accident did not arise out of, and in the course of, his employment. As to the gas-works being a factory, he argued that the sulphate-house was entirely separate from the gas-works, that the operations were quite distinct, and that no mechanical power was used in making sulphur. His Honour decided against Mr. Langden on the latter point. Mr. H. Simmonds, the Gas Engineer and Manager to the Corporation, then gave evidence to the effect that Lee had been warned against going to the sulphur-kiln alone. Other evidence having been given, His Honour held that the gas-works came within section 93 of the Factory and Workshops Act as a factory; also that Lee came by his death by an accident arising out of, and in the course of, his employment; and, further, that his death was not due to his own wilful misconduct. He awarded the amount agreed upon—viz., £247 11s. 7d.—and ordered £80 to be paid to the widow, and the balance to be paid in weekly sums of 2s. 6d. for the maintenance of each of the two children until they had reached the age of fourteen years, or until a further order was asked for.

Liability for Damaging a Lamp-Post.

At the South-Western Police Court on the 15th inst., the Idris Mineral Water Company were summoned at the instance of the Crystal Palace Gas Company for "unlawfully, carelessly, or accidentally breaking or throwing down a lamp-post, worth 19s. 6d.," belonging to the Company in Westow Hill, Upper Norwood, on July 8. Mr. Saunt, for the Company, stated that on the day in question one of the defendants' vans was standing outside a chemist's shop on Westow Hill, when, as the carman was driving away, the van caught the lamp-post. He pulled his horses to the near side; and the wheel again caught the post and knocked it down. He drove on without stopping; and by section 20 of the Gas-Works Clauses Act, 1847, the Company were entitled to recover the damage incurred. Inspector Laird, of the R.S.P.C.A., stated that he witnessed the accident. The lamp-post was caught by the van. The driver looked round, and then drew the van to the near side, and drove on again. As he did so, the van caught the post a second time, and pulled it down. Replying to the Magistrate (Mr. Garrett), witness said he believed the driver was trying to avoid a collision. Mr. Bartty Denniss, for the defendants, pointed out that section 20 of the above-mentioned Act was identical in terms with section 207 of the Metropolis Local Management Act. Under the latter, the driver of a van in such a case was responsible. It had been held under that Act that, if a driver damaged a lamp-post, the master could not be made liable. Counsel also argued that similarly a master could not be held liable if the driver accidentally damaged the post. He cited the case of *Harding v. Parker* in support of his contention. The legal point was fully discussed; and Mr. Garrett adjourned the case to last Thursday. On that day, he gave his decision against the Gas Company, holding that the master in such a case could not be held liable for the negligence of his servant. He allowed four guineas costs.

Unlawful Use of Water.

At the North London Police Court on Monday last week, Mr. Arthur Gill and Mr. George Kebbell appeared before Mr. Chapman to prosecute, on behalf of the East London Water Company, in 24 summonses taken out against consumers for unlawfully using for other than domestic purposes the water supplied by the Company. The cases were watched on behalf of the Hackney Vestry by Mr. Tiddeman. Mr. C. V. Young and Mr. D. A. Romain represented individual defendants; but there was no organized defence to the prosecutions. Mr. Gill said the summonses were taken out under section 18 of the Water-Works Clauses Act, 1863, in which it was provided that, if any person used his domestic supply for other than domestic purposes, he should be liable to a penalty not exceeding 40s. for each offence. Section 74 of the Company's Act of 1853 made it clear that they were only under an obligation to furnish a supply for domestic purposes; and section 72 provided that, among other things, water for gardens was not a domestic purpose. Section 79 gave the Company the option of supplying water for gardens, if they chose, by contract; and it was their practice, where such supply was granted, to have the quantity of water consumed registered by meter. The law on the subject was clearly intimated on all the demand-notes issued by the Company. This had been done since 1896; so that the defendants could hardly plead ignorance. In all the present cases, a hose had been employed; and for the privilege of using it none of the defendants had paid. The use of a hose was, indeed, a serious matter; for if the water were left running, a ton could soon be wasted. At the time the informations were laid, the Company were compelled, in consequence of the drought, to prevent excessive garden watering in their own interests as well as those of the consumers. In many instances the defendants had apologized; and in those cases the Company only asked for a nominal

penalty, with costs. The defendants were mostly well-to-do people, and they did not dispute that a hose had been used. Mr. Harvey Knight, of Evering Road, N., said he had used the hose for three years. Mr. Chapman: If that is so, why have you not paid for the water? Defendant: Because it was never demanded. Another defendant stated that he discontinued the use of the hose directly he saw the announcement in the papers that the summonses had been applied for. Mr. Chapman said the Company very reasonably and very properly required an additional payment from persons employing a hose; and it was clear that those who used water in this way without such payment were breaking the law. He imposed a uniform penalty of 5s. and costs in all the cases.

At the Waltham Cross Petty Sessions last Tuesday, Mr. A. Gill and Mr. G. Kebbell attended, on behalf of the East London Water Company, to prosecute three persons for using water for other than domestic purposes. One was Mr. J. Wallace, of Chingford, who acknowledged that he was in fault. Mr. Gill explained that a fountain was attached to a fish-pond on the defendant's premises, through which the water came in considerable quantity by means of a sprinkler. Defendant said there was only a small sprinkler attached to the fountain. The Chairman remarked that this was a deliberate taking of the water, and in entire contravention of the Company's conditions. Defendant would therefore be fined 20s. and costs.

At the West Ham Police Court last Wednesday, Mr. Baggallay dealt with nineteen summonses taken out by the East London Water Company against customers for using water for other than domestic purposes without consent. The majority of the defendants lived at Forest Gate. In one case, the defendant admitted that he had used the water for his garden; but he declared that there was no intention on his part to evade payment for it. He was fined 5s. and costs. Similar fines were imposed in the other cases; but some were withdrawn.

Cuckfield Water Supply.—Mr. H. A. Law held an inquiry last Wednesday at Cuckfield relative to a proposed loan of £15,000 for the water supply to the parishes of Ardingly, Balcombe, Bolney, Cuckfield Rural, Lindfield, and Slaugham. Considerable feeling was manifested by those present on the subject of the Hayward's Heath and Cuckfield District Councils being allowed to participate in the benefits of the scheme without contributing anything towards the cost of the works.

Gas Profits at Keighley.—The Gas Committee of the Keighley Corporation report that the profits for the year ended June 30 (after lighting the public lamps free of charge) amount to £12,747. Deducting from this £2445 for interest on loans, £1830 for sinking funds, £759 cost of Fire Brigade, and £45 cost of Patents Library, a surplus of £7665 remains, of which it is recommended that £3833 be placed to working capital account, £2000 handed over in aid of the rates, and the balance of £1832, together with the remainder of last year's surplus (£1263), put to a renewals and insurance account. It is also proposed to transfer to such account the present balance of £957 in the reserve fund, and to close the latter fund.

The Transfer of Water Between the Metropolitan Companies.—In the report of the Official Water Examiner (Major-Gen. Scott) on the water supply of the Metropolis during July, a statement is given showing the transfers of water effected between the Companies for that month. It appears that the Grand Junction Company supplied to the New River Company from June 25 to July 29 from the Thames 36,507,000 gallons, or an average of 1,177,645 gallons per day. The New River Company supplied to the East London Company between the same dates from the Lea 171,291,666 gallons, or 5,525,538 gallons per day; and the Southwark and Vauxhall Company delivered to the same Company from July 1 to July 31 221,175,142 gallons, or a daily average of 7,134,682 gallons.

Gas, Water, and Electricity Supply at Llandudno.—At the meeting of the Llandudno District Council last Wednesday, it was decided, on the recommendation of the Water and Gas Committee, to apply to the Local Government Board for a Provisional Order to amend the Llandudno Improvement Act, 1876, in order to borrow £5000 for the purpose of purchasing or hiring gas cooking-stoves, &c. A recommendation by the Electric Lighting Committee was also adopted in favour of applying to the Board for authority to raise £6000 to cover expenditure over and above the amount already sanctioned in relation to the electric lighting and refuse destruction works. The accounts of the water and gas undertakings for the year ended in March last showed that there was a small profit on the former undertaking for the first time since 1894. The total receipts amounted to £5819; the expenditure being £5813. The total income of the gas undertaking was £10,670; being an increase of £300 over that of last year, notwithstanding a reduction of 3d. per 1000 cubic feet during the twelvemonth.

The Gas and Water Undertakings of the Rhondda District Council.—At the last meeting of the Rhondda District Council, the Finance Committee submitted their half-yearly report, which contained, in the estimated expenditure for the ensuing half year, an item of £4677 in aid of the Gas and Water Department. This amount represents a loss on the working of these departments for the year ending March 31 last. The fact does not speak well for the management of the gas and water works since they have been in the hands of the Council. In the last year of the existence of the Ystrad Gas and Water Company, the Council's predecessors, there was a surplus of £5847 on the gas, and of £4506 on the water undertaking—together, £10,353—available for distribution. The rates charged by the Council are the same as the Company's, notwithstanding all that was said before the purchase about a reduction being possible owing to the cheaper rate at which the money to buy the works could be borrowed. It seems that, although the items of revenue and expenditure in the Gas and Water Department did not vary materially from those of the Company in the past financial year, the balance carried to the profit and loss account was insufficient to pay the interest on the loans, leaving out the question of the sinking fund altogether. The proportions of the loss on the two undertakings were: Gas, £2500; water, £2200. Curiously enough, the grand total of the district rate is less than before; and the rate agreed upon is 1s. 3d., as compared with 1s. 6d. in the pound. But the Council have been cutting down expenses, and, judging from what passed at the meeting, also overworking one of their officials.

MISCELLANEOUS NEWS.

THE PROFIT-SHARING SCHEME OF THE SOUTH METROPOLITAN GAS COMPANY.

Important Changes.

The Directors of the above-named Company, having found that some of the employees are not displaying that personal interest in the affairs of the undertaking which it was thought the introduction of the profit-sharing scheme would evoke, have decided in their case to make certain changes in the scheme. These are set forth in the following circular, addressed to the men in question by Mr. George Livesey:—

When profit-sharing was begun at these works, it was said, and has been many times repeated, that it was started with a twofold object. I never could say which was most important, but preferred to consider them of equal value. From the Company's point of view, the desire was to attach the officers and workmen to their employers by giving them a direct interest in promoting the Company's prosperity—in fact, giving them a share in its prosperity beyond their wages, to induce them to do their best for the Company. From the employees' point of view, the desire was to give them the opportunity to improve their position in the world, and to enable them to make provision for misfortune and old age.

A very large proportion, or nearly one-half, of the employees have fulfilled both objects. They take a real interest in the Company, and they avail themselves of the opportunities to better their position and to provide for the future. The other half, or rather more than half, of the employees do not thus use the profit-sharing system to their own advantage. Year by year, for the last ten years, they have had the opportunity, and have been invited, to begin to follow the example of their comrades; and, year by year, they have let it slip. In short, so far as they are concerned, profit-sharing has failed in one of its two main objects; and it is probable that in these cases it has also, to a considerable extent, failed in its other main purpose, because the man who takes little or no interest in his own permanent welfare is not very likely to take an interest in the welfare of the Company.

The system owes its success and its permanence to the large proportion of thrifty, thoughtful, and industrious men—and the more their ranks are added to, the greater will be the success of the movement. They, in fact, are the strength of profit-sharing, as the others are the weakness, and often the cause of its failure. Efforts have been constantly made, but without much success, to induce the latter to take advantage of their opportunities; and though it is very satisfactory to find that this year at Greenwich, Bankside, Old Kent Road, and Vauxhall, upwards of 100 more profit-sharers have left their withdrawable bonus to accumulate at interest, it is to be regretted that at the other two stations, where the number and amount of withdrawals were the highest in 1898, they have for the year 1899 increased.

In July last, £4923 was withdrawn by 1643 men. The officers withdrew 23½ per cent. of their total; and the percentage of the amount withdrawn by the workmen at the six stations is given below, compared with the withdrawals in the previous July: Greenwich, (1898) 31, (1899) 26½; Bankside, (1898) 50, (1899) 41½; Old Kent Road, (1898) 51, (1899) 44½; Vauxhall, (1898) 47½, (1899) 45½; East Greenwich, (1898) 47¾, (1899) 51; Rotherhithe, (1898) 68½, (1899) 69½; average of all the stations, (1898) 50, (1899) 47. [Mr. Livesey offers a few comments on these figures.] The average of all the stations is 3 per cent. better than last year, which is evidence that we are advancing slowly; but the arguments and persuasion of the last ten years have influenced only a small proportion of the men, and apparently none at all at East Greenwich and Rotherhithe.

Of the £4923 withdrawn last July, it is certain that the greater part of it has done little or no good. A small portion has no doubt been wisely used, and probably another small portion has been withdrawn from necessity; but a large proportion has been wasted, and some, it may be safely said, has been badly spent. For ten years this has been going on, and the time has now come for the use of stronger measures than mere arguments and persuasion. These measures are necessary to promote the best interests of the profit-sharers themselves, and to ensure the permanence of the system, because no system can last unless it is beneficial to all the parties interested.

Notice is, therefore, hereby given to all those profit-sharers who, during the last five years, have regularly withdrawn all their withdrawable bonus, that at the next distribution, in 1900, they will only be credited with the half bonus invested in stock, and will have nothing placed in their withdrawable account, unless they deposit with the Company, week by week, a sufficient sum to equal, by June 30, 1900, a week's wages. If they do this, the bonus will be as before; but if not, they will have nothing in the withdrawable account. Of course, if a man has withdrawn the money to invest it otherwise—in a building society, for instance, or to put it in the Post Office—this notice will not apply to him. Any man saving an amount equal to a week's wages, or more, will, of course, be perfectly free to withdraw it when he pleases; but if, after having held it long enough to entitle him to the withdrawable half bonus in July next, he then withdraws both savings and bonus, the opportunity to secure the bonus will not be repeated in the following year.

Let me say, in conclusion, that, in recommending the Board to agree to this proposal, my desire was, and is, to see the full benefits of profit-sharing extended to all those employees who have not hitherto taken full advantage of the system. I have also the further desire to so firmly establish our profit-sharing, shareholding, and share in responsibility and management arrangement, that when I am called from the work there will remain a body of officers and workmen to carry it on to the advantage of the consumers, the shareholders, and themselves. I say this in order, with all my power, to impress upon all profit-sharers that the continued success and maintenance of the system depends entirely upon them. If they become indifferent, and do not try to earn the bonus by good, hearty, and intelligent service, the thing must ultimately fail and be given up; but if, on the other hand, they will do their part heartily and thoroughly, its success and permanence will be assured.

A COMING-OF-AGE CELEBRATION AT LEICESTER.

In 1878 the Leicester Corporation purchased the gas-works from the Company who had been carrying them on from April, 1821; and therefore municipal gas supply in that busy centre of industrial activity has attained its majority. Such an event Alderman Lennard, the energetic Chairman of the Gas Committee for seventeen years, could not allow to pass without inviting a large number of his friends to come and rejoice with him; and they did so—ladies and gentlemen—to the number of upwards of a hundred on Thursday last. Before, however, specifically noticing the day's proceedings, something in the nature of a little history of the concern may be given.

The Leicester Gas Company was founded in April, 1821. For the first few years the Company did not pay a dividend; but from 1824 until the Corporation acquired the undertaking, the maximum dividends allowed by Parliament were always paid. In July, 1878, an arrangement was made between the Company and the Corporation whereby the latter took over the whole of the works which were being rebuilt at Aylestone Road. The management was delegated to a Committee of thirteen members, of which the late Alderman Grimsley was elected Chairman. In August, 1878, they reported to the Council that the net profit of the works for the year amounted to £17,284. Of this sum £9991 was paid to the late shareholders as dividends on their shares; and the balance was carried to the reserve fund—making it £42,311, which amount was transferred to the new capital account. From that time until the present, the works have steadily grown; and the profits have increased year by year. In 1879 a number of cottages were erected for the workmen adjoining the new works; and three years later Mr. G. A. Robinson was succeeded in the management by the present popular Superintendent, Mr. Alfred Colson, M.Inst.C.E. Acting upon their Manager's recommendation, the Council in 1884 erected additional plant and apparatus at the Aylestone works to meet the increased demand for gas; and in the following year new chemical works were erected at Aylestone Road, at a cost of £20,000. In 1887 further additions were made to the plant at a cost of £110,000. In the first year of Corporation ownership, the quantity of coal carbonized was 54,000 tons. This year the amount has been more than trebled; and though the population of the town has greatly increased in the same period, yet the consumption of gas has increased in greater ratio. Twenty-one years since the revenue of the department was £90,000. To-day it is above £240,000; while in the same period the quantity of gas made per day has increased from 3½ millions to over 9 millions. The amount paid for the undertaking, including the goodwill, was £476,651; and at the present time the capital amounts to £867,601. The total profit on the concern from the time of its acquisition by the Council, after paying all debts, interest, &c., amounts to the very satisfactory total of £529,940.

With such a prosperous career, it was with pardonable pride that those who had been responsible for the management of the undertaking conducted their visitors over the premises on Thursday. Tea was provided in the workmen's recreation-room, at the conclusion of which Alderman Lennard gave an account of the progress of the works. As he said, this was a more important occasion than usual; the Gas and Electric Lighting Committee having attained their majority. He proceeded to give some of the particulars already recorded, and then remarked that about six months back he ventured to tell the Council that they were on the eve of better times; and events proved he was correct, for the amount gained was the largest of any previous half year—viz., more than £20,000. Out of this they would have to pay away about £4000; leaving £15,295 on which the Chairman of the Finance Committee would lay hands. Next year, however, the profit would not be so great, owing to the large increase in the price of coal. The introduction of the electric light had made no difference in the consumption of gas; and he did not believe it would do so. The plant was laid down four years back, and had been in every way a success, comparing very favourably with other installations in the country. The number of men employed at the works was 1000; and by Christmas they would have 1300. The Committee had always preserved the best relations with their employees, and had never had any labour troubles whatever. Alderman Lennard also paid a warm tribute of praise to the Engineer and Manager (Mr. Colson), who had carried out the whole of the additions to the plant without once calling in any extraneous assistance whatever, and in this direction alone he had saved the Committee much in fees and commissions. Other speeches of a complimentary character followed. Sir Thomas Wright proposed a vote of thanks to Alderman Lennard. The Mayor seconded, and alluded to the fact that Alderman Lennard had served seventeen years on the Gas and Electric Lighting Committee, and had been one of the most valued members of the Council. During the afternoon and evening, the Gas-Works Band played a selection of music.

THE EXPENDITURE ON PUBLIC LIGHTING BY METROPOLITAN LOCAL AUTHORITIES.

A recently issued return shows, according to the accounts for the twelve months preceding March 31 last, furnished to the Local Government Board under section 1 of the London (Equalization of Rates) Act, 1894, the following figures as the expenditure in respect of lighting by each of the Sanitary Authorities to whom payments under the Act were made in the year by the London County Council: Vestries.—Battersea, £9032; Bermondsey, £2916; Camberwell, £15,320; Chelsea, £4815; Clerkenwell, £3849; Fulham, £6228; Hackney, £10,625; Hammersmith, £7411; Islington, £23,930; Lambeth, £15,132; Mile End Old Town, £4085; Newington, £4686; Plumstead, £2397; Rotherhithe, £2109; St. George-in-the-East, £2076; St. George-the-Martyr, Southwark, £2238; St. Pancras, £18,190; Shoreditch, £8313; Stoke Newington, £1806—total, £145,158. District Boards of Works.—Greenwich, £8366; Lee, £3684; Lewisham, £8929; Limehouse, £3293; Poplar, £8147; Wandsworth, £15,436; Whitechapel, £4535—total, £52,390. The Woolwich Local Board of Health spent £1864, and the Corporation of London £22,085; making a grand total of £221,497.

OTTOMAN GAS COMPANY, LIMITED.

The Half-Yearly Meeting of this Company was held last Tuesday, at the London Offices, No. 9, Queen Street Place, E.C.—Colonel James Le Geyt Daniell in the chair.

The Secretary (Mr. Thomas Guyatt) read the notice convening the meeting; and the report and accounts were then submitted.

The Chairman said that, considering the depression in trade in the country in which the Company carried on their operations, and certain new charges upon revenue—viz., the interest upon the debentures which it was necessary for the Company to issue to comply with the requirements of the Ottoman Government when granting a new concession, and also the charge which they had to make every year as a matter of prudence for the sinking fund, in consequence of the Ottoman Government having granted the concession, but modified to the term of 40 years, while the Board applied for, and hoped to get, a full 70 years—he hoped the shareholders would regard the report as satisfactory. The report (which, as customary with this Company, was very concise) informed them that the gas-rental for the six months amounted to £8869, and that the net profit available for division was £3086. It also mentioned the manner in which it was proposed to deal with the profit, and further stated that the special resolutions passed by the shareholders in March last had received the necessary sanction of the Court of Chancery, and had thus become law. In giving some details as to the operations of the half year, he referred first to the balance-sheet. The capital account, he said, was practically adjusted; and the whole of the expenditure required by, and stipulated for at the time of the negotiation for, the new concession had now been carried to that account. Sundry debtors, it would be observed, stood at £8571, against £16,442 this time last year, and £18,512 at the end of 1898. These latter items he had explained at previous meetings; but the present amount (£8571) included £6167 due for private and public lighting. Another item in the balance-sheet, "Goods in transit, £1143," represented a cargo of coal at sea, which had not been delivered, but had been paid for, at the date at which the accounts were made up. The item of "stocks" included the usual details—such as fittings, coal, new mains, meters and meters on hire, retorts, &c. The amount of cash and bills was now £5132, against £17,555. On the other side of the account, sundry creditors (£2122) included £1100 sinking fund, which had since been invested in Consols. Regarding the revenue account, there was nothing special to draw attention to; but he might mention that the quantity of coal carbonized during the half year was 3131 tons, and the cost was about £3560. The average cost per ton, including freights, was 3s. 4½d. per ton above that of the corresponding period of last year. The total amount of gas made was 32,295,700 cubic feet; the average production per ton of coal carbonized being satisfactory. Before closing his remarks, the shareholders would probably expect him to make some reference to the electric light question, which had occupied attention at previous meetings, and to which allusion had been made in various newspapers. From what he could ascertain, the application for electric lighting in Smyrna had so far failed; their own Company having recognized prior rights. This was, however, a subject upon which he should prefer to observe some reticence rather than invite discussion or criticism; and he would ask the shareholders not to press him unduly, for reasons which, in the interests of he Company, would be readily understood. A great deal of activity had been evinced, and it was as necessary on the part of the Board to be active likewise. But so far as their information went, any concession that might have been granted for Smyrna had been limited to electric traction. He might perhaps mention *en passant* that this question of electric tramways was not a new one, and that it had been carefully examined with the Manager when it had cropped up on previous occasions. Though electric traction might not directly concern the Company, electricity did; and it was well for them to be on the alert at every point. Of course, he did not know what advantages might have been offered in this connection which did not previously exist; but he should be surprised if the promoters did not meet with disappointment when brought face to face with the facts. The shareholders could rest assured that the Directors were fully alive to the interests of the Company in this direction; and he trusted that they would leave the matter with confidence in their hands. He had no desire to burke any question; but he hoped he had made it clear that, while negotiations were proceeding by promoters of electric interests, it was as well to keep their own counsel as much as possible within four walls. He concluded by moving the adoption of the report.

Mr. Charles Gandon seconded the motion.

Mr. Hounsom said he was glad to find the Directors had taken the subject of the sinking fund in hand; and he hoped it would continue from year to year, even if it involved a slight diminution of the dividend. The dividend was a very good one; and shareholders who went in for investment would be thoroughly satisfied to see the stability of the Company maintained and increased.

A number of questions were put by Mr. W. Hughes, Mr. J. Tysoe, Mr. A. M. Paddon, and Mr. James Cooper.

The Chairman, in reply, said the special law charges during the half year amounted to under £100. The gas accounted for per ton of coal was good; and the gas unaccounted for showed an improvement of 3 per cent. compared with the corresponding half of last year, and could not be considered bad for an eastern country. It was true that the net profit, after deducting the debenture interest, was £2200, which was not quite equal to the amount required for dividend. But they had a balance of undivided profit, and, after paying the dividend, would still have something in hand. The reserve fund was used in the business; but the sinking fund was at present invested in Consols.

Mr. Charles Gandon pointed out that the reserve fund was employed as trading capital; but they had £5000 in cash, besides sundry debtors and stocks.

Mr. John Gandon (the Engineer), in answer to an inquiry, stated that they were doing their best with gas cooking-stoves; but he could not say they were making the progress he should like to see.

The motion was unanimously carried.

A dividend at the rate of 7 per cent. per annum was declared, free of income-tax.

On the motion of Mr. F. E. Linging, seconded by Mr. A. M. Paddon,

a hearty vote of thanks was passed to the Chairman and Directors; and afterwards, on the proposition of the CHAIRMAN, seconded by Mr. R. L. ANDREWS, a like compliment was paid to the Secretary, Engineer, and staff—the shareholders taking advantage of the presence of the Engineer to specially acknowledge their appreciation of his faithful services.

PUBLIC LIGHTING IN PLYMOUTH.

Inauguration of the Electricity Works—Incandescent Gas Lighting.

The Plymouth municipal electricity undertaking was formally inaugurated last Friday, and the streets in the centre of the town, as well as the Hoe promenade, were at night illuminated for the first time by electric arc lamps. In connection with the electric lighting plant, there is a system of electric traction for the Corporation tramways; and it is claimed for Plymouth that these are the first works in the country to commence with a combined lighting and tramway load. So far as the first day went, the undertaking proved most successful. The tramcars were crowded during the day with passengers, many of whom took the journey from one end of the line to the other—a distance of about a mile-and-a-half—out of curiosity. In the evening, the improved lighting of the streets was very noticeable. Plymouth has hitherto been indifferently, not to say badly, lighted. This, as Mr. J. H. Rider, the Electrical Engineer and Lighting Superintendent, said on Friday, has been the fault of the Corporation rather than of the Gas Company. Until they took up the electric lighting scheme, the Corporation were reluctant to listen to suggestions for improving the lighting of the streets; and even in the heart of the town it has been far from what it ought to be. This complaint is not likely to be heard in the future. The arc lamps are sufficiently close together to give a fairly diffused light, and though on Friday the moon added to the bright appearance of the streets, it does not seem that there is much room for complaint of the "spottiness" of the lighting. Nor is the improvement confined to the business centre of the town. In the main thoroughfares leading to the suburbs, incandescent gas lighting is being established, in accordance with the recommendation of Mr. C. R. Bellamy, the Lighting Superintendent of Liverpool. This work is being carried out in a thorough manner—the latest Welsbach burner and the most approved lantern being adopted; so that Plymouth promises to take a place among the best lighted towns of the country.

The electricity undertaking, of which particulars have been given in the "JOURNAL" from time to time, has cost about £56,000. This is £10,000 in excess of the original estimate; the difference being mainly in the cost of the generating station, which was largely under-estimated. In the town there has been some criticism of the time expended over the work. It is exactly three years and a half since Mr. Rider was engaged as Electrical Engineer, and a little more than three years since his plans were prepared and approved by the Corporation. A company, it is suggested, would have done the work much more expeditiously; and this is probably true. On the other hand, Mr. Rider points to the delay which arises in municipal work in obtaining the approval of Committees, then of the Town Council, and finally in getting the sanction of the Local Government Board to the borrowing of the money. Moreover, if the work has been slow, it is, he claims, sure and good. In all, 21 miles of cable have been laid, and the undertaking starts with orders for 8000 8-candle power lamps; the total load, including the tramways, being now equal to 17,000 lamps. Mr. Rider claims that the undertaking is starting with the cheapest rate—4½d. per unit to private consumers—ever charged at the beginning of an undertaking in this country. The charge for public lighting—£16 per arc lamp per annum, including labour and maintenance—is also, he says, much below the usual price. He admits that even at this low figure the cost of public lighting by electricity will be double that of gas. In reality, it is to be about two-and-a-half times as much; Mr. Rider's own estimate being that the arc lamps will cost £1184 per annum, as compared with £475 for the gas-lamps displaced. Of course, Mr. Rider contends that for double the cost he is giving twenty times as much light; but he did not tell his audience what would have been the difference in the cost, as well as in the actual light, if the Corporation, instead of electric arc lighting, had adopted for the centre of the town the same efficient system of incandescent gas lighting as they are providing for the suburbs.

Friday's ceremony consisted of a formal starting of the machinery by the Mayor (Alderman J. Pethick), in the presence of members of the Town Council and other leading men of the borough. The party then rode in the tramcars from the tramway terminus, near the generating station at Prince Rock, to the terminus in the centre of the town, opposite the Theatre Royal. There was afterwards luncheon at the Guildhall, when a number of congratulatory speeches were made; and Alderman C. H. Radford, the Chairman of the Electricity Committee, presented to the Mayor, in the name of that Committee and also of the Tramway Committee, a very handsome bronze figure holding an electric incandescent lamp.

Ryde Gas Company.—At the recent annual general meeting of this Company, the Directors reported that an expenditure of £900 for the completion of a stack of retorts and £400 for a washer reduced the balance available for distribution to an amount insufficient by £425 to pay the maximum dividend. To make up the deficiency, £400 had already been withdrawn from the reserve fund; and it was proposed to take the balance therefrom. The new regenerative system of heating retorts had been used exclusively during the year, and had completely justified the Manager (Mr. F. F. Farrand) in advising its adoption. More gas had been made at less actual cost for wages, and with little more than half the fuel used under the old system. The quantity of gas sold during the year was an increase of 5·65 per cent. on that of 1897-8. The accounts accompanying the report showed that the sale of gas produced £10,513; the returns from residuals amounted to £3033; and the total revenue was £13,909. The manufacture of gas cost £8288 (including the extraordinary expenditure above mentioned); distribution, £376; and management, £825—the total expenses being £10,397. A balance of £3512 was consequently left to be carried to the profit and loss account. The report was adopted.

ELECTRIC LIGHTING NOTES.

An inquiry was held at Hastings last Thursday, with reference to an application by the Town Council for power to borrow £38,623 for purposes of electric lighting.

The Littleborough District Council have decided to apply to the Board of Trade for a Provisional Order, to enable them to provide electric lighting. The question of purchasing the gas undertaking has also lately been receiving a good deal of attention.

The Shildon District Council have had a report presented to them on a scheme of dust destruction and electric lighting, which is estimated to cost £17,254. The annual cost of running is calculated at £2244; and the revenue at £2860. This looks far too expensive a scheme for a town of the size of Shildon; and the Council should examine very closely the ground on which the estimate of the probable income is founded.

A long discussion took place at the meeting of the Brighton Town Council last Thursday, on a report from the Lighting Committee recommending that application be made in the next session of Parliament for power to borrow money for the establishment of an electricity generating station at Aldrington Basin, to the west of the Gas Company's works. The scheme presented provided for the acquisition of 10 acres of land at a cost of £3600; but, as it is dependent on the obtaining of parliamentary powers, no allusion was made to the cost of constructing the works. The report was adopted.

By a majority of eleven votes to two, the Exmouth District Council have decided to apply for a Provisional Order empowering them to undertake the electric lighting of the town. The advocates of the scheme based their case mainly on the ground that the existence of another monopoly in the town should be prevented, and recalled the fact that some years ago the Gas Company were prevented, through the action of the Local Board of that day, from obtaining electric lighting powers. Attention was called by the opponents of the scheme to the want of evidence that the monopoly would be worth having. There was nothing to show that electric lighting paid in small places like Exmouth. On the contrary its introduction was always attended by loss, at least for the first few years. The majority, however, decided to keep out the invading Company at any cost.

The scheme for the electric lighting of Epsom was laid before Colonel A. C. Smith, one of the Inspectors of the Local Government Board, last Wednesday. The amount which the Council applied for sanction to borrow is £16,100; and it was stated that sufficient plant would be provided to supply the current for the whole of the public lighting, and for the equipment of 4000 8-candle power lamps for private consumers. The question whether the scheme will pay its way naturally causes considerable anxiety in the minds of the ratepayers; and on this point the Engineer (Mr. W. C. C. Hawtayne) was unable to cite a single instance where in a town of similar size to Epsom, the adoption of the electric light had resulted in a profit to the local authority. Two members of the Council gave evidence in opposition to the scheme, which one of them characterized as a speculation which was almost certain to result in a loss, and a consequent additional burden upon the rates. Counsel for the opposition urged that the statistics before the Local Government Board proved absolutely that the adoption of the electric light by a small local body meant a failure from a commercial point of view. On the other hand, it was pointed out that several private companies were anxious to secure the transfer of the Council's Provisional Order, and that this circumstance justified the conclusion that the concern might reasonably be expected to yield a fair return.

Candid recognition of the fact that an electric lighting undertaking will be a source of loss for four or five years has not removed every objection to the proposal of the Penzance Corporation to engage in the business of manufacturers and suppliers of electricity. When the question of applying for a Provisional Order came before the Town Council a few days ago, considerable opposition was offered to it. Timid councillors suggested that the Council should begin in a very moderate way, with a limited compulsory area, and extend operations as the demand increased. Others thought that proceedings might be advantageously deferred until after the elections on the 1st of November, when it might be made a test question. Another proposal was that the carrying out of the work and the risk should be left to a company. With regard to this suggestion, it was pointed out that there was nothing to prevent the Corporation delegating their powers to a company if they pleased; but as matters had progressed so far, it was necessary to proceed without delay with the application for a Provisional Order. Power is to be taken, if the Board of Trade and Parliament will grant it, to raise by loan a sum sufficient to pay the interest and sinking fund for five years from the commencement of the works. A member of the Council, however, suggested that the loss was likely to continue for twenty years, and require a rate of 1s. in the pound to cover it.

By a unanimous vote, the Totnes Town Council decided last Tuesday to support the application of the Totnes Electricity Supply Company for a Provisional Order for the electric lighting of the town. A letter was received from the Directors of the Gas Company urging the Council not to consent to the application; but the members of the Council were uninfluenced by its arguments. The Directors pointed out that, with a view to improving the lighting of the town, the Company had in the past two years laid out on new mains, gasholders, &c., upwards of £2500, equal to 50 per cent. of the paid-up capital, and that the price charged for gas compares very favourably with that of any other town of the same size in Devon or Cornwall. In their opinion, there was not room in the town for two lighting companies to be carried on with satisfaction to the shareholders, more especially as the capital of the new Company was double that of the Gas Company—viz., £10,000 against £5000. They considered that the Council would be justified in not supporting the application by the fact that the Board of Trade refused some months ago to grant an Order to an Electric Lighting Company in South Wales, on the ground that the existing Gas Company had efficiently lighted the town and district, and it was not possible that the limited supply required could maintain two companies. This was, the Directors remarked, an exact parallel to the case of Totnes, the growth of which was so small that there was no likelihood of much increased lighting power being required in the future. The Town Council appear to have thought that this was none of their business and that the Companies ought to be left to fight the matter out for themselves. Another consideration which, no doubt, had weight with them

was that electric lighting schemes are being promoted in neighbouring towns of no greater size or importance than Totnes.

A special meeting of the Newark Corporation was held on Monday last week to receive the recommendation of the Electric Lighting Committee on the supply of electricity to the borough, and as to the application for a Provisional Order. In the absence of the Mayor (Alderman Hole), Alderman Saunders presided. The Town Clerk (Mr. G. Tallents) read the minutes of the Committee, who, having obtained a report from Mr. Vesey Brown on the best means of supplying electricity within the borough, and the probable cost of the works, recommended the Council to apply to the Board of Trade for a Provisional Order. The Chairman of the Committee (Mr. Knight) said they had very carefully considered Mr. Brown's report, and were unanimously of the opinion that application ought to be made for an Order. The Council would naturally wish to know what was the proposed compulsory area, and what was the estimated cost of supplying it. The system Mr. Brown proposed to adopt was the low-pressure continuous-current three-wire system, with a pressure at the consumer's premises of 220 or 230 volts. The cost of supplying the compulsory area was estimated at £14,343, and the extended area would require 3000 yards of cable, which would cost £1050—making a total, in round numbers, of £16,000. The estimated income was £1760, which would meet the cost, assuming it was put as follows: Interest and redemption, £850; salaries and wages, £525; coals and stores, £350; general establishment charges, £35. From this it would be seen that the undertaking would pay its way, and not be a charge upon the borough rates, if the price were fixed at an average of 6d. per unit. The Committee had compared these figures with those from other towns, and they thought they represented a very fair estimate of what the cost might be, and of the revenue that would be derived. He therefore moved the confirmation of the minutes. Alderman Earp seconded the proposition. Mr. Perfect said there were several very extensive schemes looming in the near future, and he suggested that it would be wise to postpone the electric lighting question for the present. There was nothing urgent about it. Mr. Slater said he did not regard the scheme as at all likely to be a burden on the ratepayers, but as a paying investment which would tend to reduce the rates. Mr. Perfect asked where the income of £1760 was to come from. Mr. Skerritt replied that the Corporation had already a large item towards it, inasmuch as they themselves paid an average of £500 a year for lighting the town. The motion was carried, with only two dissentients.

The Gas, Water, and Electricity Committee of the Ramsgate Town Council had under consideration last Friday the report prepared by the Gas and Water Engineer (Mr. W. A. Valon, J.P.) on the proposed supply of electrical energy within the borough limits. The report was made in accordance with a resolution passed on the 30th of March, the terms of which were to the effect that Mr. Valon was to furnish information on the following matters: (1) The desirability of the lighting being undertaken by the Corporation or placed in the hands of an independent body. (2) The probable initial cost of the installation in either case. (3) The best system to be employed, having regard to extensions for the future. Mr. Valon dealt fully with each branch of the subject; taking, however, the cost last. As to the first matter, he pointed out that the trend of public opinion is in the direction of municipal trading, and expressed the belief that in future local government would possibly embrace nearly all, if not the whole, of the gas, water, and electrical supplies of the United Kingdom. He went on to say that it is not an uncommon thing for a corporation or a district council to obtain electric lighting powers, and lease them to a company on conditions which usually embrace re-purchase. On the other hand, a corporation may stand aside and allow a company to come in. Having set out in detail the six reasons generally advanced on behalf of companies as the pioneers and suppliers of electric current, Mr. Valon remarked that they might all be equally well urged in favour of gas and water supplies now under the control of local authorities, and that these bodies, when properly advised, were in just as good a position as companies to act on that advice. He pointed out that at the present time the tendency is for the electric lighting industry to go largely into the hands of these bodies; and he cited in support of his statement the fact that in the years 1896-8, Provisional Orders numbering 120 were issued to them, compared with 25 granted to companies. He gave some tables, compiled from "Burdett," showing the details of the working of 53 installations, all started and carried on by local authorities, and another containing a selection of towns comparable with Ramsgate. He remarked thereon that local authorities are generally able, in virtue of their control of the public lighting, to commence with the advantage of an assured demand for electricity. This, however, would not apply to Ramsgate, where the Corporation had already successfully installed the incandescent gas system. As to the best method of supply to be adopted, Mr. Valon thought the three-wire direct-current system, at 440 volts, would be the most preferable; and he provided for this in his estimate. He explained that the scheme would include a battery consisting of 280 cells, sufficient to supply 580 lamps for five hours, or (say) 100 lamps for ten hours. This would allow of the station being shut down in the daytime and provide a reserve. The generating plant would comprise two dynamos, each of 75 kilowatts (1250 16-candle lamps), coupled direct to an enclosed vertical engine running at 350 revolutions per minute. He estimated the cost of the plant at £19,300. Adding 10 per cent. for contingencies brought this sum up to £21,230; and the further addition of £3500 for the engine and boiler house, foundations, and buildings, and £1500 for trench work for cables, made the total £26,230. As to the income to be derived from the undertaking, Mr. Valon thought the price of 6d. per unit should return £2000 per annum, reckoning upon two-thirds of the lamps wired being in use. As to the cost of running, he considered 2½d. to 3d. per unit sold would be a fair figure to take. In the course of some general remarks at the close of the report, Mr. Valon suggested 30s. per point as a fair charge for wiring with simple fittings; and he advised that everything in connection with the consumer's installation should be dealt with by the Corporation. He gave a table showing the relative cost of electricity and gas for 1460 lighting hours per annum and per candle-hour. The figures are as follows: Electricity (16-candle lamp) at 6d. per unit, £2 6s. 8d. per annum, or 0·024d. per candle-hour; at 5d., £1 18s. 11d., or 0·02d.; at 4d., £1 11s. 2d., or 0·016d.; and at 3d., £1 3s. 4d., or 0·012d. Gas at 2s. 8d. per 1000 cubic feet—Argand burner (16-candle power), 19s. 6d., or 0·01d.; "C" Welsbach burner (56-candle power), 14s. 7d., or 0·0021d. Light for light, therefore, the cost of electricity at 6d. per unit is 2·4 times that of gas, at 2s. 8d. per 1000 cubic feet, consumed in an argand burner.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 752.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 13	10½	Alliance & Dublin 10 p. c.	22—23	+½	4 11 4
100,000	10	,,	7½	Do. 7 p. c.	15½—16½	..	4 10 11
800,000	100	July 3	5	Australian 5 p. c. Deb.	102—104	..	4 16 2
200,000	5	May 12	6	Bombay, Ltd.	6—6½	..	4 12 3
40,000	5	,,	6	Do. New, £4 paid	4½—4¾	..	5 1 1
880,000	Stk.	Aug. 16	12	Brentford Consolidated	277—282	..	4 5 1
270,000	,,	,,	9	Do. New	210—215	..	4 3 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
159,375	,,	June 15	4	Do. 4 p. c. Deb.	126—130	..	3 1 7
220,000	Stk.	Sept. 15	11½	Brighton & Hove Orig.	265—265*	..	4 6 9
226,320	,,	,,	8½	Do. A. Ord. Stk.	190—195*	..	4 7 2
973,500	Stk.	Aug. 16	5	Bristol, 5 p. c. max.	125—130	..	3 16 11
430,000	20	Mar. 29	10	British	44—46	..	4 6 11
50,000	10	Aug. 31	12	Bromley, Ord. 10 p. c.	24—26	..	4 12 3
75,000	10	,,	9	Do. 7 p. c.	19—21	..	4 5 8
500,000	10	Apl. 27	6	Buenos Ayres (New) Ltd.	9½—10½	..	5 17 1
220,000	Stk.	June 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
150,000	20	July 13	8½	Cagliari, Ltd.	28—29	..	5 13 10
100,000	10	June 1	7½	Cape Town & Dis., Ltd.	13—14	..	5 7 2
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	57—59	..	5 1 8
550,000	Stk.	Apl. 13	13½	Commercial Old Stock	316—321	..	4 4 1
200,750	,,	,,	10½	Do. New do.	245—250	..	4 4 0
200,750	,,	June 15	4½	Do. 4½ p. c. Deb.	143—148	..	3 0 10
800,000	Stk.	June 15	10	Continental Union, Ltd.	185—187	..	5 7 0
200,000	,,	,,	7	Do. 7 p. c. Pref.	182—187	..	3 14 10
51,600	Stk	Aug. 31	14	Croydon A 10 p. c.	335—340	..	4 2 4
168,400	,,	,,	11	Do. B 7 p. c.	265—270	..	4 1 5
555,000	Stk.	Aug. 16	5½	Crystal Palace Ord. 5 p. c.	132—137	..	3 16 8
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	July 28	11	European, Ltd.	22—23	..	4 15 8
354,060	10	,,	11	Do. £7 10s. paid	16—17	..	4 17 1
14,998,075	Stk.	Aug. 16	4½	Gas-light and Coke	4 p. c. Ord.	103—106	−1½	4 12 5
2,600,000	,,	,,	3½		3½ p. c. max.	97—100	+1	3 10 0
3,799,735	,,	,,	4		4 p. c. Con. Pref.	123—125	..	3 4 0
3,993,975	,,	June 15	3		3 p. c. Con. Deb.	100—102	..	2 18 10
70,000	10	May 31	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4
3,800,000	Stk.	May 12	10	Imperial Continental	222—227	−1	4 8 1
473,600	Stk.	Aug. 16	3½	Do. 3½ p. c. Deb. Red.	101—104	..	3 7 4
75,000	5	June 15	6	Malta & Medn., Ltd.	5—5½	..	5 9 1
560,000	100	Apl. 4	5	Met. of	5 p. c. Deb.	112—114	..	4 7 9
250,000	100	,,	4½	Melbourne	4½ p. c. Deb.	110—112	..	4 0 4
541,920	20	May 31	5	Monte Video, Ltd.	12½—13½	..	7 8 1
617,946	Stk.	Aug. 31	9½	Newc'tle & Gatesh'd Con.	225—230	..	4 0 5
264,855	Stk.	June 29	8½	Do. 8½ p. c. Deb.	106—109	..	3 4 3
				* Ex div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
150,000	5	May 31	8	Oriental, Ltd.	7½—8	..	5 0 0
135,000	5	,,	8	Do. New, £4 10s. pd.	6½—7	..	5 14 3
15,000	5	,,	8	Do. do. 1879, £1 pd.	1½—1¾	..	4 11 5
60,000	5	Mar. 29	7	Ottoman, Ltd.	5½—6	..	5 16 8
500,000	100	June 1	6	People's Gas of Chicago } 2nd Mtg. Bonds	102—106	..	5 13 2
851,070	10	Apl. 27	7	River Plate Ord.	11½—11¾	..	5 19 2
250,000	Stk.	June 29	4	Do. 4 p. c. Deb.	100—102	..	3 18 5
250,000	10	Sept. 15	10	San Paulo, Ltd.	14½—15½*	−1	6 9 0
135,000	Stk.	Sept. 15	10	Sheffield A.	247—245*	+6½	4 0 4
309,953	,,	,,	10	Do. B.	247—249*	+6½	4 0 4
447,427	,,	,,	10	Do. C.	247—249*	+6½	4 0 4
5,600,000	Stk.	Aug. 16	5½	South Metrop., 4 p.c. Ord.	140—143	..	3 14 7
1,520,000	,,	July 13	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
120,000	Stk.	Aug. 31	6	Tottenham A. 5 p.c. and B. 2½ p.c.	141—143	..	4 3 11
250,520	,,	,,	4½		102—104	..	4 6 6
55,100	,,	—	4	Edmonton 4 p.c. Deb.	115—120	..	3 6 8
182,380	10	June 15	5	Tuscan, Ltd.	9—10	..	5 0 0
149,900	10	July 3	5	Do. 5 p. c. Deb. Red.	98—100	..	5 0 0
				WATER COMPANIES.			
746,184	Stk.	June 29	11	Chelsea, Ord.	313—318	..	3 9 2
150,000	,,	,,	5	Do. 5 p. c. Pref.	167—170	..	2 18 10
160,000	,,	,,	4½	Do. 4½ p. c. Pref. '75	148—153	..	2 18 10
175,785	,,	Mar. 29	4½	Do. 4½ p. c. Deb.	155—160	..	2 16 3
1,720,560	Stk.	Apl. 13	7	East London, Ord.	207—212	−1	3 6 0
654,740	,,	June 29	4½	Do. 4½ p. c. Deb.	155—158	..	2 17 0
390,000	,,	,,	3	Do. 3 p. c. Deb.	101—103	..	2 18 3
700,000	50	June 15	7½	Grand Junction 10 p. c. max.	111—114	..	3 5 9
310,000	Stk.	Mar. 29	4	4 p. c. Deb.	135—140	..	2 17 2
708,000	Stk.	Aug. 16	14	Kent	358—363	..	3 17 2
160,000	,,	,,	7	Do. New, 7 p. c. max.	208—213	..	3 5 9
1,043,800	100	June 29	10½	Lambeth, 10 p. c. max.	298—303	..	3 9 4
406,200	100	,,	8	Do. 7½ p. c. max.	225—230	..	3 9 7
350,000	Stk.	Mar. 29	4	Do. 4 p. c. Deb.	138—142	+2½	2 16 4
500,000	100	Aug. 16	13½	New River, New Shares	430—440	..	3 1 4
1,000,000	Stk.	July 28	4	Do. 4 p. c. Deb.	135—140	..	2 17 2
902,300	Stk.	June 15	7½	Southwark Ord.	205—210	..	3 11 5
126,500	100	,,	7½	7½ p. c. max. and 5 p. c. Pref.	193—198	..	3 15 9
489,200	Stk.	,,	5		167—172	..	2 18 2
1,019,585	,,	Apl. 13	4	Vauxhall 4 p. c. A Deb.	135—140	..	2 17 2
1,155,066	Stk.	June 15	10	West Middlesex	300—305	..	3 5 7
200,000	,,	,,	4½	Do. 4½ p. c. Deb.	154—158	..	2 17 0
200,000	,,	Sept. 15	3	Do. 3 p. c. Deb.	101—103*	..	2 18 3
				* Ex. div.			

and more than 11 times that of gas used with a "C" Welsbach burner. Mr. Valon acknowledged that in the preparation of his report he had had the advantage of consulting with, and receiving the advice and assistance of, Mr. Alfred Colson, of Leicester, where the electric light was installed by the Corporation in 1893. The Chairman of the Committee (Mr. C. J. Gwyn, J.P.), in opening the meeting, said his opinion was that the report was a very full one, giving information on all the points asked for, and in language which all could understand. He thought it was, on the whole, a favourable report; and it seemed to him as if it would lead to a step on the right road. The Engineer had been at some pains to get full details, and expressed himself clearly that the scheme, if undertaken at all, should be worked by the Corporation. They had a site ready for the purpose, and the system recommended for adoption was the three-wire direct current. The amount to be expended was £26,230; and he believed the district, as far as it was marked out to be mained, was fairly representative of the minimum cables required. In reply to members of the Committee, the Engineer said he did not know of any place where the use of the dust destructor for the production of anything outside itself had been satisfactory. Mr. Hawkes confirmed this; stating that he asked the question at Bradford, and they gave him the same opinion as that which the Engineer had just expressed. The Chairman said the result of the meeting would no doubt be to ask for power to apply for a Provisional Order; and he went on to say that although the electric light had advantages in many respects, it was, to a certain extent, a luxury. For public lighting, he did not think anything could have better effect than their incandescent gas system; but for shops, warehouses, large buildings, and private consumers, there was a field for the electric light. The Engineer called the attention of the Committee to the fact that the figures given in the table showing the relative cost of electricity and gas were based on the assumption that the two illuminants were in use for the same length of time; but, in practice, it was found that this difference in the cost of the two lights was materially reduced in the case of the electric light by the facilities afforded for controlling the current. The report having been adopted, Mr. Hawkes proposed and Alderman Blackburn seconded—"That the Committee recommend that application be made to the Board of Trade for a Provisional Order to enable the Corporation to supply electricity in the borough, and that the subject be referred to the Mayor, the Chairman of the Committee, the Engineer of the Gas and Water Works, Consulting Engineer to the Corporation, and the Town Clerk, with a view to steps being taken for the purpose; and that they be authorized to consult Parliamentary Agents in the matter." The resolution was put and carried unanimously.

Additional Capital for the Newcastle and Gateshead Gas Company.—At an extraordinary meeting of the above-named Company last Wednesday, the Directors were authorized to increase the capital by the issue of £50,000 of ordinary stock and £25,000 of 5 per cent. preference stock.

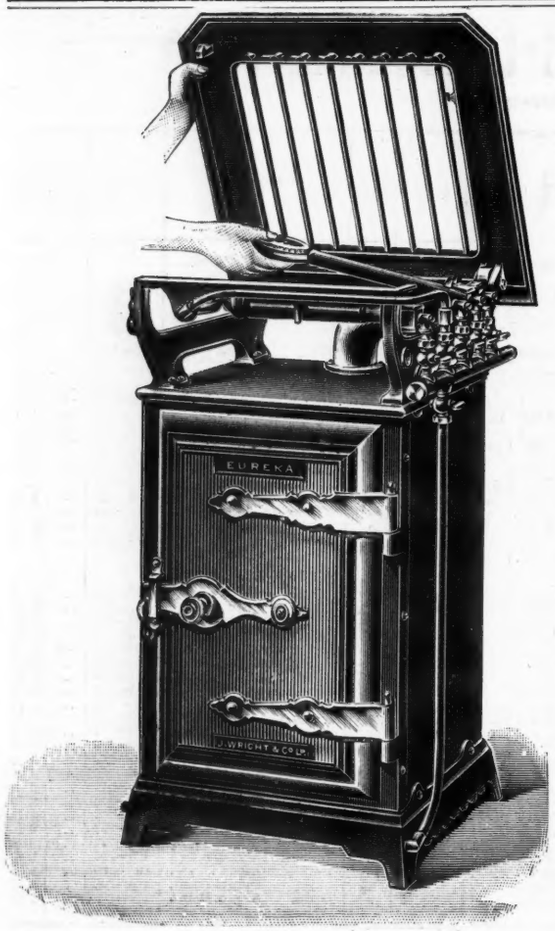
NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Gas Committee of the Dundee Town Council on Tuesday accepted the following tenders for the erection of the new retort-house and coal-stores in the gas-works: Ironwork, the Barrowfield Iron-Works, Limited, £8747; brickwork, Mr. W. Anderson, of Dundee, £1143; and slater work, Mr. C. Brand, of Dundee, £381. On the same day, the Committee agreed to recommend the purchase of 500 tons of small steam coal for the gas-works, at 8s. 5d. per ton, and of other 500 tons at 9s. per ton.

The town of Dunbar is one of those which are in the ascendant; the cause, in its case, being the increasing popularity of the game of golf. Since this turn for the better came, there has been an obvious improvement in the conduct of the public representatives of the town, which everyone will wish to see continued. The administration of the gas-works, since they came into the hands of the Corporation, has not been of the happiest description. It has improved of late—probably owing to the better returns which were being reported by the Gas Manager (Mr. F. Chalmers). I am tempted to wonder whether the good counsels will continue to prevail, or whether the events of the near future may not be too much for men of the calibre of the Dunbar Corporation. The chief event was foreshadowed in a report which the Manager submitted to the Commissioners at their last meeting, in which it was stated that the increase in the make of gas still continued—the increase during July having been 113,000 cubic feet, and during August 159,800 cubic feet. Since May 15, the increase has been at the rate of 23 per cent. over the same period of last year. At this rate of increase, the report proceeded, the works will require to undergo alterations of an extensive nature; otherwise it will be absolutely impossible to maintain a supply of gas during the winter of 1900. A new and larger retort-bench will require to be built, and all the piping about the works considerably enlarged. Chokes in the piping are of daily occurrence, entailing endless annoyance and worry, besides great loss. A new washer and scrubber will also require to be put down. This would relieve the purifiers of a great proportion of the work of purification, and would decidedly be a paying concern. He was at present preparing a sketch plan of a scheme which would meet all the requirements, and provide plant of sufficient capacity to cope with the demand for a number of years, and at a very low cost. This winter all the retorts in the house will be in use; and as they will in any case require renewal at the end of the ensuing season, he thought it would be to the advantage of the undertaking to erect the new plant early next spring, so that it might be ready for use in the autumn. The Manager then proceeded to advise regarding the enlargement of mains, which, he suggests, should proceed at once. Finally, he informed the Commissioners that the stokers in the works had applied to him, verbally, for an increase of wages. The report was continued for consideration. I have no doubt that Mr. Chalmers requires all that he desiderates, in order to enable him to carry on his work effectively. But what he asks for is a large instalment; and it will likely be found



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WRIGHT'S PATENT,
BY WHICH ALL THE
ADVANTAGES OF LOOSE BURNERS
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WITHOUT
ANY OF THE DISADVANTAGES.

NO EXTRA CHARGE IS MADE
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that he will need to exercise all his persuasive powers before he gets his wants supplied.

The Peterhead Town Council have, on the recommendation of their new Manager (Mr. G. Keillor, jun.) agreed to furnish gas-burners free to all consumers who may apply at the office for them. The total cost, it was stated, would be from £6 to £8. Mr. Keillor also reported upon the subject of the working up of residual products. He had, he said, obtained information from several gas-works throughout the kingdom, as to the profits obtained from the disposal of the bye-products; and he found that the highest price was 3s. 3d., the lowest 2s. 8d., and the average about 3s. per ton of coal carbonized. This year there was a rise of about 20 per cent. in the price of coal; and there would be a deficit upon the year's transactions. It was more desirable than ever that they should not increase the price of gas; and he recommended the adoption of modern methods of dealing with residual products. He estimated the cost of a complete plant which would be suitable at £650, the gross profit at £322, and the net profit at £251 per annum. This was equal to a return of about 2s. 6d. per ton of coal used, and a gain of 1s. 9d. per ton as compared with the existing arrangements. He did not recommend the acquisition of the plant already in use in the town, as the additional first cost of suitable apparatus was soon paid for by an enormous saving in fuel. Provost Smith said that the new plant would recoup itself in two or three years. Mr. Keillor was a specialist on the subject; and he moved that his recommendation be adopted. Mr. Farquharson, who has purchased the residual products for many years, wrote offering to sell his plant to the Commissioners; and in agreeing to adopt Mr. Keillor's suggestions and giving authority for the work being proceeded with, the Town Council directed the Committee to purchase any portion of Mr. Farquharson's plant which could be utilized.

At the recent annual general meeting of the St. Andrews Gas Company, the accounts presented showed a net income of £5266 from the sale of gas for ordinary consumption, and a total revenue of £6092. The expenditure being £4655, there was a balance of £1437. The Chairman (Mr. J. Ritchie Welch), in moving the adoption of the Directors' report, congratulated the shareholders on the continued prosperity of the Company, which, he said, was largely due to the good management of Messrs. J. & R. Hall, the Managers. It was agreed that the dividend should be the same as last year (50s. per share), and also that, notwithstanding the advance in the price of coal, the charge for gas should remain as at present—viz., 3s. 4d. per 1000 cubic feet. It is interesting to note that Mr. Jesse Hall will, at the beginning of next year, attain his jubilee as Gas Manager in St. Andrews. The meeting closed with votes of thanks to the Managers, and to Mr. Welch for presiding.

A year ago the Stirling Town Council placed a higher valuation than before upon the undertaking of the Gas Company, who appealed to the Court of Session. Only this week have the Town Council disposed of the question of the costs incurred. There was a feeling that the Town Clerk ought to have carried through the proceedings himself; but this official employed professional assistance, which he thought the town should pay for. The amount was restricted to £18. At this week's meeting, the question was raised as to the authority upon which the legal assistance was called in. This having been explained, the account was passed for payment. In the course of the conversation, one gentleman showed the chagrin with which the councillors view the whole question of the valuation of the works. He objected, he said, to this account being paid by the ratepayers, because they had not been told, at the time of the appeal, that the Gas Company had called in the Assessor of Railways and Canals, who had reduced the valuation by £338, which meant a loss of rates to the amount of £70. It was explained that the application to the Assessor was advertised, and that the Council could not appear in the matter. It is the old story of the biters being themselves bitten.

The conviction is growing upon me that where electric lighting is likely to do injury to gas lighting is not in large centres of population, where gas affairs have been efficiently managed, and the charge is low, but in small places, where the gas plant has been neglected in order that a dividend might be earned, and is now obsolete, and in many instances worn out, and where the charge is abnormally high. In such places the cost of electric current is easier compared, or contrasted, with the charge for gas; and we may expect to find the success of electric lighting illustrated by results obtained in them. Fort William is already lighted by electricity. Lerwick and Kirkwall are likely soon to have installations established in them; and in the case of the latter, the Town Council have been assured recently that the charge for electricity will be less than that for gas. This, we know, is a plea frequently employed by promoters of electric light installations, and very often used in the manner of many vendors of wares, without much regard for the facts of the case. It has often been necessary to let in daylight upon the undisplayed portions of reports and prospectuses. The necessity for doing so is not yet past; and I am happy to find a very good example of this work in a letter contributed this month to the "Kelso Mail" by Mr. A. C. Young, Manager of the Kelso Gas Company. Mr. Young proves clearly that Kelso, with 11,000 yards of streets, could not be effectively lighted by ten arc lamps of 1000-candle power each; and that gas would be both a cheaper and a better light. As to the cost for private lighting, he gives figures to show that gas costing ¼d. consumed in an ordinary burner gives 28-candle power, and if consumed in an incandescent burner 125-candle power; and that electricity costing ¼d. (7d. per unit) gives 9-candle power. Such an exposure is timely; but I do not suppose it will have any effect in checking the ardour of those whose occupation it is to push the adoption of electricity. No general rule can be laid down for dealing with invading electric light promoters; but a very safe one, which could be followed generally, would be for all gas companies and corporations to see that, no matter at what cost, their plant should be modernized, whereby they would be enabled to reduce the price of gas, and thus anticipate the inevitable day of arrival of their competitor. There is still a great deal to be done in the way of cheapening the price of gas in small places. In very few instances, indeed, should the price be beyond 5s. per 1000 cubic feet, which represents a total cost of production at the rate of £2 10s. per ton of coal carbonized—a figure which it surely should be easy to reduce. Places like Kelso, where the price of gas is about 3s. 6d. per 1000 cubic feet, are showing a good example.

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SALTLEY WORKS, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR STREET WORKS, BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.,	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
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On account of the failure of the Contractors, Messrs. J. Young and Sons, to complete the Talla reservoir for the Edinburgh and District Water Trust, the Trust have resolved to advertise for offers for the completion of the work. The original contract by Messrs. Young and Sons amounted to about £163,000, and the amount of work certified is about £49,000, which includes the cost of providing the huts (£3000) and of plant (£2000). Roughly speaking, about three-fourths of the work still remains to be executed. It is probable that a higher price will have to be paid, owing to the rise in wages, the scarcity of men, and the additional cost of material, such as cement. The Engineer reported to a meeting of the Works Committee on Tuesday, that, as instructed by the Trustees, he had seen Mr. John Best, and that he had made arrangements for carrying on the works at the reservoir to the extent of putting into the trench the clay that had already been brought up, as well as that standing in waggons in the sidings of the Trustees' railway; and, further, that a squad of men was being kept on for raising up the bank so as to prevent any chance of flooding the trench in case of heavy floods. Also, it was stated that he was having a valuation made of the plant, huts, and material on the ground, and he had arranged that Mr. Hill, C.E., Consulting Engineer of Manchester, should visit the works.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 23.

Sulphate of Ammonia.—Notwithstanding continued buying, prices have again drooped; and the closing quotations are £11 15s. to £11 18s. 9d. per ton, delivered f.o.b. at the ports. The London quotation for October-December delivery has been reduced to £11 10s. per ton, Beckton terms; and this has occasioned further weakness on the prompt and near positions. But there are speculative sellers abroad at a substantial discount on the equivalent of the price; and this no doubt accounts for the weakness of the prompt and near positions. It affords encouragement to buyers to defer their operations as long as possible; and at the same time an incentive to producers to take advantage of the still relatively high prices as fast as their production becomes available. There are no stocks in makers' hands.

Nitrate of Soda, owing to further arrivals, is a shade easier; and spot price of fine quality is now 7s. 7½d. per cwt.

LONDON, *Sept.* 23.

Tar Products.—There is no special feature of note in connection with these. The demand and prices are fairly steady, especially in pitch and carbolic acid. Benzol stiffened a little from the bottom price; but there is not much further advance apparent, nor is there much new business being done. There is brisk inquiry for creosote salts and naphthalene; but prices are not such as to induce much business. Inquiries for anthracene have been more active; but buyers' ideas of value at present fail to meet those of the producer.

Prices may be taken as: Tar, 16s. 6d. to 25s. 6d. Pitch, east coast 35s., west coast 33s. 6d. Benzol, 90's 8d., 50's 9½d. Toluol, 1s. 2d. Solvent naphtha, 1s. 2d. Heavy naphtha, 1s. 1½d. Crude, 30 per cent., naphtha, 4d. Creosote, 3¾d. Heavy oils, 70s. Carbolic acid, 60's 2s. 1d., 75's 2s. 7½d. Creosote salts, 55s. Anthracene, nominal, "A" 3½d., "B" 2½d.

Sulphate of Ammonia has eased somewhat from last week, and £11 10s. to £11 15s. is apparently what buyers are willing to pay for prompt delivery.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A considerably increased demand has been coming forward for all descriptions of round coal suitable for house-fire purposes; and there has also been a more active inquiry for fuel for steam, forge, and general manufacturing requirements. This extra buying has no doubt to some extent been influenced by the general anticipations of an upward move in prices; and, notwithstanding collieries are mostly working from five to six days per week, the output is barely sufficient to keep up with requirements of customers, with the result that there has been a complete stoppage of anything going down into stock. The probability is that collieries will enter upon the winter with only very limited supplies to meet the season's extra requirements. As intimated in previous reports, the month will close with a general advance in prices; the Lancashire Coal Sales Association having decided to put up their list basis 1s. per ton on round coals, and 6d. on burgie and slack. The leading Manchester collieries, who have a separate Association of their own, are advancing all classes of round coal 10d. per ton, and engine fuel 5d. In the meantime collieries, except for retail orders to private consumers, are only booking at present rates for delivery this month; and it is merely on current sales that quotations can be given at 11s. 6d. to 12s. 6d. per ton at the pit for best Wigan Arley, 10s. to 11s. for Pemberton four-feet and seconds Arley, 9s. 6d. for common house coal, 8s. 9d. to 9s. 3d. for steam and forge coal, 6s. 9d. to 7s. 3d. for best slack, 6s. to 6s. 6d. for medium, and 5s. 6d. for common sorts. Shipping is fairly brisk, with prices tending upwards; steam coal averaging 9s. 9d. to 10s. 3d. per ton delivered at the Garston Docks, and 10s. to 10s. 6d. at the High Level, Liverpool, or the Manchester Ship Canal. With regard to coke, furnace qualities are scarcely so strong; but there is no really quotable giving way—18s. to 20s. remaining about average figures, with foundry qualities maintaining late rates of 26s. to 27s. at the ovens.

Northern Coal Trade.—There is a good demand for Durham coal, but that for steam sorts is very limited at present. The stormy weather has made it difficult to get coals away; steamers being delayed. Best Northumbrian steam coals are plentiful, and weaker in price, at about 11s. to 11s. 3d. per ton f.o.b. Second qualities are about 10s. 6d., and steam smalls are scarce at 6s. 9d. to 7s. In the gas coal trade, there is a strong demand; and for occasional cargoes the price varies from 10s. 6d. to 11s. per ton f.o.b. There have been some sales of gas coals for export over next year; but though the details are not yet obtainable, it is believed that the price varies from 9s. 9d. to 10s. per ton f.o.b.

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Manufacturing coals are very steady, with a full demand; the prices being unaltered this week. Gas coke is rather more irregular in price; and for shipment the quotations have varied from 13s. 3d. to 14s. per ton f.o.b. in the Tyne.

Scotch Coal Trade.—There is an improved demand for most classes of coal. Ell and splint are in greatest request, with values tending to rise. The prices quoted are: Main 9s. to 9s. 3d. per ton f.o.b. Glasgow, ell 9s. 9d. to 10s. 9d., and splint 9s. 9d. to 10s. 3d. The shipments for the week amounted to 211,856 tons—a decrease of 1511 tons when compared with the previous week, and of 31,166 tons upon the corresponding week of last year. For the year to date, the total shipments have been 6,281,392 tons – a decrease on last year of 805,691 tons.

The Kitson Lighting and Heating Syndicate, Limited, has been registered with a capital of £10,000 in £10 shares, to acquire, under certain agreements made by the Company with Messrs. A. & E. Kitson and W. Clapham, patent rights relating to improvements in lighting and heating apparatus, and to develop and work the same.

Determined Suicide by Gas at Croydon.—At Croydon a few days since, Dr. Jackson, the Borough Coroner, held an inquest on the body of Henry Sutton, aged 63, a retired publican, who committed suicide in the kitchen of a house in Northcote Road by turning on all the taps of a gas-stove. The evidence showed that deceased was a great sufferer from cancer, in addition to which he seemed to have some mental troubles; for of his own accord some time since he consulted Dr. Forbes Winslow. The Jury returned a verdict of "Suicide during temporary insanity."

High Wycombe Gas Company.—The energetic manner in which the works and business of this Company have of late been developed is bearing fruit of a kind which must be highly gratifying to the shareholders. At the recent meeting, the profit justified the Directors in recommending an increased dividend at the rate of 6 per cent. for the half year on the ordinary shares (making 12 per cent. for the year), and at the rate of 4½ per cent. on the additional shares, making 9 per cent. for the year, free of income-tax. The Directors were also able to report the exceedingly satisfactory increase in sales of nearly 15 per cent., which they attribute largely to the fact that the improvements made in the gas industry generally are being gradually adopted not only for lighting and heating, but also for motive power. The number of gas cookers and grillers sold or on hire amount to 584, and slot meters to 645. The new plant adopted at the works is also giving the anticipated economical results. In addressing the shareholders, the Chairman (Mr. T. Marshall) spoke with pleasure of the fact that the Company were able to pay an additional ½ per cent. dividend, and still enabled to carry a considerable balance forward. This and the increased consumption were proof that the fears entertained in some quarters regarding the effect of the opposition of electric light were groundless. Before the meeting concluded, the interest which the Chairman takes in the Company, and the energy which the Manager (Mr. J. F. Wicks) has displayed in bringing the works up to their present efficient state, were appropriately acknowledged.

Water Scheme for Douglas.—Messrs. G. H. Hill and Sons have been appointed Engineers for the new water scheme for Douglas, which is being carried out at a cost of £50,000. The engagement lasts for five years, and the fee is £4000; beyond that period the ordinary professional charges will be paid. The Corporation have acquired the estate of Ardwhallan, consisting of about 92 acres of land, at a cost of £2910. Despite the long drought, it was reported at the last meeting of the Water Committee that there were 29 million gallons of water, or 21 days' supply, in the present reservoirs, in addition to the ordinary flow of the stream.

Gas Traction for Tramways in Germany.—The following appeared in the "Financial Times" last Friday: "It appears that, notwithstanding the great development of electric traction in Germany, the two leading firms engaged in the electrical industry in that country are convinced that, where permission is refused for the introduction of electric tramways on the ground of objections to the use of overhead wires from an æsthetic point of view, it may not be impossible to obtain consent to the institution of a service of gas-driven cars, against which no such obstacles can be raised. It is with this object in view, and in order as much as possible to control the tramway business, that the well-known firm of Messrs. Siemens and Halske, of Berlin, and the Union Electricity Company, of the same city, with the assistance of financial institutions, have formed the German Power-Gas Company, which acquires the Oechelhæuser gas-motor patents, both for Germany and abroad; the Aschersleben Engineering Company and the Pein Rolling Mills being also interested in the Company. It will now be possible for the new Company, with the influential support behind it, to promote almost any kind of tramway, so as to meet the diversified wishes of different localities and different people."

Sales of Shares.—Last Wednesday, Messrs. Lancaster and Sons sold at Barnsley eight "D," one "E," and one "G" share (£10) in the Barnsley Gas Company, carrying 7 per cent., at £14 apiece; some "F" (10 per cent.) shares, of the same nominal value, fetching £18 5s. each. At Plymouth, 28 shares, issued under the Act of 1879, in the Plymouth and Stonehouse Gas Company, were recently sold at from £21 12s. to £21 15s. each; and some shares in the Devonport Gas Company realized £11 2s. 6d. apiece. At Boston, last Wednesday, Messrs. J. G. Killingworth and Son sold some old shares (£10) in the Boston Gas Company, carrying a dividend of 8½ per cent., at £18 10s. each. At the Lion Hotel, Cambridge, last Wednesday, Messrs. Grain, Moyes, and Wisbey sold by auction some original consolidated stock of the Gas Company, the property of the late Mr. Dennis Adams. Six lots of £50 of 10 per cent. stock fetched £123 10s., £124, and £125 10s. respectively; and two £50 lots of 7 per cent. stock went for £86 10s each, and one for £87. Other £50 lots of 7 per cent. stock realized £83 10s., £85 10s., and £86. A parcel of consolidated old ordinary stock in the Staffordshire Potteries Water Company was sold at Hanley, last Tuesday, at the record price of £238 per cent. On the preceding day, £245 of 5 per cent. preference stock in the Broadstairs Water Company was disposed of locally. The stock was put up in £50 lots, and realized altogether £314 10s. At the same auction, £20 of 4 per cent. debenture stock in the same Company fetched £21 15s.

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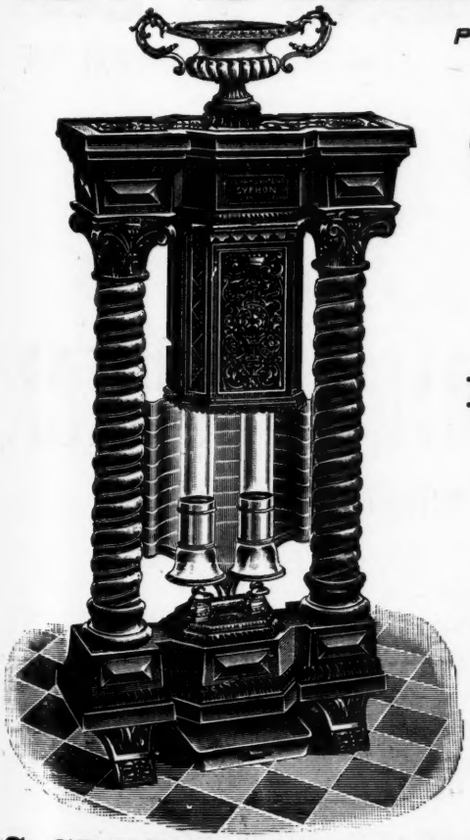

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Clacton Gas and Water Works Purchase.—The Clacton District Council last Wednesday decided to apply to the Public Works Loan Commissioners for a loan of £100,000, to cover the purchase-money for the gas and water works, and the cost of contemplated improvements.

A Gas-Meter Making Establishment in Glasgow.—As a result of the arrangement of the Corporation gas-meter contract for the ensuing year, a new industry has been founded in Glasgow—viz., the manufacture of gas-meters. One of the three contracting firms—Messrs. Thomas Glover and Co., Limited, undertook, in the event of their being entrusted with the contract, or part of it, that the work would be done in Glasgow; and in accordance with this undertaking, they have secured premises in M'Alpine Street as meter-works, and have commenced operations. Hitherto the manufacture of gas-meters has been confined in Scotland to Edinburgh.

Bridlington District Council Water-Works Loan.—The Bridlington District Council last Thursday affixed their seal to agreements with the Prudential Assurance Company for loans of £69,035 and £964 respectively. The larger loan was obtained at 3½ per cent. (to be repaid in fifty annual instalments of £2747 2s. 1d.), for the purpose of repaying to the Bank of England the loan, which was somewhat hurriedly withdrawn, because of the inordinate delay on the part of the Water Committee and Council in taking up the loan of £70,000 preferred and accepted at 3 per cent. interest. The smaller loan was for payment of the expenses of the Bridlington Water Act, 1894.

Hastings and St. Leonards Gas Company.—The half-yearly report of this Company (which was noticed in the "JOURNAL" for the 5th inst.) was presented at the recent meeting of the shareholders by the Chairman (Dr. Gray). In the course of his remarks, he said it was not unnatural that the Directors should give prominence in their report to the passing of the new Act. The half-year's working had been as successful as preceding half years, and as compared with their neighbouring competitors, they were placed once more at the top of the tree. For the first time their capital had reached £250,000; and for the first time the make and sale of gas amounted to 200 millions. The expenditure, as compared with the previous half year, showed an increase of £1650, while the increase in the receipts was £1553; the latter including an increase of £658 in the sale of gas. The net result therefore was that, with the exception of £96, the increased expenditure had been met by the receipts. They had a net profit of £11,000. The Company had issued an additional 554 prepayment meters, and 721 stoves; making a total of 3902. Dealing with the new Act, Dr. Gray said they were at first threatened with opposition from five quarters; but eventually they obtained everything they asked for, and more than he expected. Having explained some of the advantages of the Act, he alluded to the Directors' remuneration, and said it was thirteen years since it was raised. He also spoke of the increase in the Company's work since that period. The report was adopted. There was some conversation regarding the remuneration of the Directors; and the feeling of the shareholders was that it should be raised from £500 to £1000. Notice is to be given that the question will be considered at the next meeting.

The Cumberland Water Scheme.—At last Tuesday's meeting of the Wigton Rural District Council, it was stated that the probable cost of providing the Wigton rural district with water from Lake Overwater and the upper reaches of the Ellen, to which reference has already been made, would be £22,000. This total consists of £10,000, one-third share of works at the source and main; £6000 for a branch from Mealsgate to Kirkbride, *via* Oulton and Eskrigg; £2200, from Kirkbride to Bowness; £1760, from Kirkbride to Glasson and Port Carlisle; and £1980, from Mealsgate to West Newton and Allonby. A Committee was appointed to make further arrangements.

The Public Health Congress.—The congress of the Royal Institute of Public Health was opened at Blackpool last Thursday by the Marquis of Lorne. In the course of his address he dwelt upon the practical and immediate requirements of large populations, such as good milk and water supplies. He said that as the number of persons augmented, as the smoke of factories grew denser, as the pollution of rivers and harbours increased, it became more and more necessary to have a good milk and water supply. He urged his audience to agitate, and make the agitation a hardy annual, for less smoke and purer drains, and proceeded to give a review of methods of sewage disposal practised in various places. Alluding to the use of sea water for sprinkling roads, he mentioned that it had lately been discontinued at Brighton. In conclusion, he recommended the maxim, "Live in cleanliness and godliness."

The Nidd Water-Works of the Bradford Corporation.—Last Thursday, the final heading of the Greenhow Hill tunnel—probably the most difficult portion of the Nidd water-works scheme of the Bradford Corporation—was made, and the borings met with perfect accuracy, both as to line and level. Operations for the construction of this tunnel, which is nearly four miles long, have been in progress since July, 1894. It was driven from three shafts, as well as from each extremity; and one of the shafts measured as much as 425 feet from the surface of the hill to the level of the tunnel. The average depth of the works from the surface of the ground is upwards of 300 feet. In its present form, the tunnel is 8 ft. 6 in. in height, and 7 ft. 6 in. in width; but it is to be lined throughout with concrete to a thickness of from 12 to 18 inches, though in places where the strata is fissured or disturbed the concrete lining will be as much as 2 ft. 6 in. thick. The finished section of the tunnel will be 6 ft. 3 in. high and 5 ft. 6 in. wide. It is estimated that the lining will take nearly two years to complete. This finishes, so far as the driving is concerned, the last of the four tunnels which constitute so important a feature of the Nidd scheme. The first is Rainstang, which commences at the River Nidd, and terminates at Arnthwaite Gill. It is 1½ miles in length, and is driven at a depth of 500 feet beneath Rainstang. Proceeding south, the second tunnel is rather over a mile long; commencing at Burn Gill, and terminating at Ashfold Side Beck. The lining of both of these tunnels is almost completed. The next in order is the Greenhow Hill tunnel; and the fourth is a small tunnel 288 yards long, to the north of Holden Beck, in the township of Silsden. This tunnel has been completed, and the water from Upper Barden has been passing through it for upwards of two months.

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JOHN WM. O'NEILL, Managing Director, 160, 161, & 162, PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to the Company as above.

WINKLEMANN'S ORIGINAL "VOLCANIC" FIRE CEMENT and "VOLCUM" PASTE. Always ready for use in GAS-WORKS. Resists 4500° Fahr.

ANDREW STEPHENSON, 183, Palmerston Buildings, Old Broad Street, E.C.

"Volcanism, London."

BROTHERTON & CO.

Offices: Commercial Buildings, LEEDS. Correspondence invited.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER, LINCOLN." [For Illustrated Advertisement, see Sept. 5, p. 618.]

AMMONIACAL LIQUOR wanted.

BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SHEFFIELD CHEMICAL COMPANY, LIMITED.

BUYERS of Spent Oxide. Sellers of OXIDE OF IRON and SULPHURIC ACID.

PATENTS FOR INVENTIONS.

Messrs. J. C. CHAPMAN & CO., Chartered Patent Agents, ADVISE ON ALL MATTERS CONNECTED WITH ABOVE.

Information and Handbook on application. 70, CHANCERY LANE, LONDON, W.C.

SPENT OXIDE wanted.

BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.

Telegrams: "ENAMEL." National Telephone 1769.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

PRACTICAL RETORT SETTERS.

BATES & NUTTALL, 32, Havelock Road, Saltley, Birmingham.

Regenerator or other Furnaces erected to Engineers' own Designs. Best Work Guaranteed. Please write for Estimates.

MELROSE CYCLES

SHOULD be bought by Gas and Water Officials. Ladies' No. 1, £10 10s.; No. 2, £8 10s. Gents' No. 1, £10; No. 2, £8. Highest Quality. Twelve Months' Guaranty. Sent on approval. Catalogue free. MELROSE CYCLE COMPANY, COVENTRY.

SULPHURIC ACID for Sale.

BROTHERTON AND CO., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BENZOL, specially made for the Enrichment of Gas.

ELLISON AND MITCHELL, LIMITED, Kilnhurst, near ROTHERHAM.

GAS CARBON Wanted, not less than 4-Ton Loads.

Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special attention to Repairs.

Before placing Orders, please write for Estimate. Telegraphic Address: "SATURATORS, BOLTON."

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM; and 45 & 47, Westminster Bridge Road, LONDON, S.E.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Addresses: "Braddock, Oldham." "Metrique, London."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

HYDRATED OXIDE OF IRON.

PREPARED from Pure Iron.

Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.

READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

GAS TAR wanted.

BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GLOBE Chemical Works, Marple, near Manchester, Sell the most reliable and best OXIDE OF IRON for Purifying Gas. Purity and Quality guaranteed

Sellers of the best RETORT CEMENT, and Buyers of SPENT OXIDE.

IRON OXIDE (Bog Ore), best quality, for the Purification of Gas, containing up to 85 per cent. Hydrated Oxide of Iron, and absorbing while being used a high percentage of Blue.

S. BOWLEY AND SON, Wellington Works, Battersea Bridge, LONDON, S.W.

THE Post of Manager for Small Works as advertised in the "JOURNAL" for Aug. 22, No. 3330, is now filled up; and the Directors of the said Company wish TO THANK all those who sent in Applications and Copies of Testimonials for same.

WANTED, a re-engagement by a Gas Engineer who has had Fifteen Years' practical Experience as ENGINEER and MANAGER. Willing to take position at Home or Abroad. Age 37.

Address No. 3339, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVERTISER seeks position as COLLECTOR or CLERK and COLLECTOR to Gas or Water Company. Thorough knowledge of Office routine and Secretarial work. Highest References.

Address No. 3334, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO GAS MANAGERS AND LOCAL AUTHORITIES.

DRAWINGS and Specifications for all kinds of Gas Plant prepared by experienced Gas Engineer. Prompt attention, and reasonable Prices.

Address No. 3351, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ADVERTISER (aged 27), with Eight Years' Experience in Gas Lighting, desires position in a Gas-Works, where he could gain an insight into Gas Manufacture. Salary at first not so important as thorough insight. Good References. State Terms.

Address No. 3353, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a re-engagement as Engineer and MANAGER of Gas-Works (or would accept position as Assistant). Has had considerable experience in the Construction and Re-construction of Plant, working of Stoking Machinery, &c., and erecting and working Plant for the Distillation of Tar and Ammoniacal Liquor. Willing to go Abroad.

Address No. 3340, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, an Engagement by the Advertiser, a GAS MANAGER, with extensive Home and Colonial experience, who will be disengaged in the early part of the month of October. Well up in all the details of modern Gas-Works Construction and its Management, and the most approved Appliances introduced to economize the production of Gas and extend its use. Practically acquainted with both American and German Carburetted Water-Gas Plant and its manipulation. A good Draughtsman and Accountant. Satisfactory References and Testimonials.

Address No. 3332, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Manager for small Gas-Works at Sharpness Docks, Gloucestershire, to take entire charge. Must be practical Fitter. Salary £100 a year, with House, Coal, and Gas free.

Applications, accompanied by References, should be addressed to the ENGINEER, Dock Company, GLOUCESTER.

SEASON 1899.

BALE'S OXIDE OF IRON, of finest Quality. Summer delivery specially recommended for efficiency and economy.

FIRE CEMENT, PAINT, and CHEMICALS. 120 and 121, NEWGATE STREET, LONDON, E.C.

SADLER & CO., Ltd., Middlesbrough, Tar Distillers and Tar Colour Manufacturers. BENZOL specially prepared for Gas Enrichment free from Sulphur. Pure Hydrated OXIDE OF IRON for Purifying Gas either for Sale or Lent on Hire. Always Buyers of GAS TAR and AMMONIACAL LIQUOR.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.

Prices, &c., will be forwarded on application to No. 30, ST. ANDREW SQUARE, EDINBURGH, or NEWTON GRANGE, NEWBATTLE, DALKEITH, SCOTLAND.

WANTED, for the Petersfield Gas-Works, a STOKER and LAMPLIGHTER. Wages 24s. 6d.

Apply to Mr. BURLEY, Station Road, PETERSFIELD.

WANTED, immediately, a handy Man for Water-Works, able to work small Worthington Engine and Boiler, lay on Services, &c. Wages 25s.

Apply, by letter, to No. 3323, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Draughtsman, accustomed to Retort-Settings and general Gas-Works Plant. Salary 45s.

State Age and Experience to the LEEDS FIRE-CLAY COMPANY, LIMITED, Engineering Department, Wortley, LEEDS.

WANTED, a leading Stoker, to take charge of a small Gas-Works under Manager. Must be capable of acting without supervision, and thoroughly understand the working of Gas-Engine and Exhauster. Salary 35s. per week.

Applications, with Testimonials, to the MANAGER Gas-Works, CHESTER-LE-STREET.

CORPORATION OF WALLINGFORD.

THE Gas Committee of the Corporation require the services of a competent WORKING MANAGER. Wages 35s. per week, with good House and Garden, Coal, Gas, and Rates free.

Must be a good Mechanic and Carbonizer. Able to lay Mains and Services, fix Meters, and effect ordinary light repairs of the Plant.

The Sale of Gas is about 7 Million Cubic Feet per annum.

Applications to be sent in to the Town Clerk, Wallingford, not later than the 29th of September.

WANTED, a really efficient and reliable HEAD CHEMIST. One who is methodical in his ways, and accustomed to the routine of Iron and Steel Works. A man who has a taste for original work, and is accustomed to the Analysis of Gases, the determination of the Calorific Values of various Substances, and the Microscopic Examination of Iron and Steel, will have the preference. Salary to begin with £200 per year.

Apply, by letter, stating Experience and Qualifications, to No. 3343, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A Gas-Exhauster, capable of passing 100,000 cubic feet per hour.

THOS. HORN AND SONS, Gray Street, WATERLOO ROAD, S.E.

IRON ROOF for Sale, 132 feet long by 53 ft. 4 in. Span, in first-class condition.

Apply to CLAYTON, SON, AND CO., LIMITED, Hunslet, LEEDS.

TOWER Scrubber (5 ft. by 20 ft.) Shell, Wrought Iron, with Flanges, Openings, and Manholes. £35. Bye-Pass and Boards if desired.

Address No. 3352, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

ENGINE and Exhausters, 20,000 and 30,000 cubic feet per hour, delivered immediately. Cheap to clear.

J. F. BLAKELEY, Thornhill, DEWSBURY.

CAST Tank, 31 feet diameter, 12 feet deep, £4 15s. per ton. Straps and Bolts included. Five Years old.

J. F. BLAKELEY, Thornhill, DEWSBURY.

PATENT for Sale in valuable Automatic GAS GOVERNOR or REGULATOR for Gas-Works, which will govern any Changes of Pressure from Day to Night, &c., that it may be set to. Patented by parties who have had long experience in Gas Pressures and Distribution.

Address SAMUEL FARMER, 29, Third Street, ELIZABETH, N.J., U.S.A.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

BARNOLDSWICK URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

THE Council are prepared to receive TENDERS for the purchase of from 30 to 40 Tons of SPENT OXIDE OF IRON, and for the supply of 15 or 20 Tons of NEW OXIDE OF IRON, Natural or Artificial.
Particulars may be obtained from the undersigned.
Tenders to be sent in by the 4th of October, 1899, addressed to the Chairman of the Gas Committee, and endorsed "Tender for Oxide."
D. E. GARLICK,
Manager.

RADCLIFFE AND PILKINGTON GAS COMPANY.

THE Directors of this Company invite TENDERS for the purchase of 750 Tons of the surplus TAR to be produced at their Works in Radcliffe during the Eleven Months commencing the 1st day of November next.
Particulars may be obtained from the undersigned, to whom endorsed Tenders must be delivered not later than Tuesday, the 3rd of October.
JAS. BRADDOCK,
Manager and Secretary.
Gas-Works, Radcliffe,
Sept. 20, 1899.

EDINBURGH AND LEITH CORPORATIONS GAS COMMISSIONERS.

TO PIPE FOUNDERS.

THE Commissioners are prepared to receive TENDERS from Pipe Founders for the supply of about 5000 yards of 48-inch and 24-inch CAST-IRON MAIN PIPES, delivered free on rail Edinburgh, or *ex* Ship Granton Harbour.
Specification and Schedule of Quantities may be obtained on application to the Chief Engineer and Manager, Mr. W. R. Herring, Edinburgh.
Tenders to be lodged with the undersigned on or before the 7th day of October next.
The Commissioners do not bind themselves to accept the lowest or any Tender.
JAMES M'G. JACK,
Clerk.
25, Waterloo Place,
Edinburgh, Sept. 14, 1899.

NEWTON-IN-MAKERFIELD URBAN DISTRICT COUNCIL.

TENDERS FOR ABOUT 300 TONS OF CAST-IRON PIPES.

THE above Council invite Tenders for an estimated quantity of 300 Tons in weight of 14-inch, 8-inch, 6-inch, 4-inch, and 3-inch diameter respectively of TURNED and BORED CAST-IRON SOCKETED PIPES and a small quantity of open SOCKET SPECIAL PIPES.
Tenders to be made on Forms which, together with a Specification, may be obtained of the undersigned.
Such further Information as may be necessary may be obtained of Mr. Lloyd, Gas and Water Engineer, Town Hall, Earlestown, Lancashire.
Sealed Tenders, endorsed "Tender for Cast-Iron Pipes," and addressed to the Chairman of the Gas and Water Committee, to be delivered to me at my Office not later than Saturday, the 30th day of September inst.
The Council do not bind themselves to accept the lowest or any Tender.
W. W. SHIBLEY,
Clerk to the Council.
Clerk's Office, Town Hall,
Earlestown, Lancs., Sept. 14, 1899.

BRISTOL WATER-WORKS COMPANY.

ISSUE OF £20,000 3½ PER CENT. PERPETUAL DEBENTURE STOCK authorized by the Bristol Water-Works Act, 1888, with Interest payable Half Yearly.

THE Directors of the Bristol Water- Works Company give NOTICE that they are prepared to receive on Friday, the 29th of September, 1899, TENDERS for £20,000 3½ PER CENT. PERPETUAL DEBENTURE STOCK.
According to the last Annual Account, the Net Revenue of the Company exceeded £85,000; and the Dividends and Interest payable on Capital and Debenture Stock ranking before the Debenture Stock now offered do not exceed £15,450.
The Minimum Price, below which no Tender will be accepted, has been fixed at £117 for every £100 of Stock.
Tenders must be delivered at the Secretary's office, Bristol Water-Works Company, Small Street, Bristol, before Two o'clock on the above day, accompanied by a deposit of £5 per cent. on the nominal amount of Stock tendered for, and the balance of the amount allotted will be payable on or before the 31st of October, 1899. Where no allotment is made, the deposit will be refunded in full.
In the event of the receipt of Tenders for a larger amount of Stock than that to be issued at or above the Minimum Price, the Tenders at the lowest price accepted will be subject to a *pro ratâ* diminution.
Applications must be made upon printed forms, which may be obtained in London of Messrs. Prescott and Co., Limited, Bankers, and in Bristol of Messrs. Prescott, Dimsdale, Cave, Tugwell, and Co., Limited, Bankers; Messrs. Fussell and Co., Solicitors, 86, Corn Street; or at the Company's Offices, Small Street, Bristol.
ALFRED J. ALEXANDER,
Secretary and General Manager.
Bristol, Sept. 19, 1899.

COMMERCIAL GAS COMPANY.

THE Directors of the Commercial Gas Company are prepared to receive TENDERS for the Surplus BREEZE produced at their several Works, for the Twelve Months ending the 30th of September, 1900.
The quantities are estimated to be as under; but the same cannot be guaranteed, and may be more or less:—
At the STEPNEY WORKS, on the Regent's Canal—
1000 chaldrons (of 48 bushels) of Fine Coke Breeze, and
1000 chaldrons (of 48 bushels) of Rough Pan Breeze.
At the WAPPING WORKS, on the River Thames—
2000 chaldrons (of 48 bushels) of Fine Coke Breeze, and
2000 chaldrons (of 48 bushels) of Rough Pan Breeze.
At the POPLAR WORKS, in Bow Creek (free waterway)—
5000 chaldrons (of 48 bushels) of Fine Coke Breeze, and
5000 chaldrons (of 48 bushels) of Rough Pan Breeze.
The Tenders may be for the whole or for one or more Works separately.
The Contractors must give security to remove the Breeze as it accumulates, to pay for the same monthly, and generally for the due fulfilment of the contract.
The Form of Agreement to be signed can be seen at the Company's Offices.
Tenders, sealed and endorsed "Tender for Breeze," to be delivered here not later than the 5th of October prox.
The Directors reserve to themselves the right to accept any Tender in part or in whole, and do not bind themselves to accept the highest or any Tender.
Commercial Gas-Works,
Stepney, E., Sept. 15, 1899.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held MONTHLY, at the Mart, Tokenhouse Yard, E.C.
He also undertakes the issuing by Auction of Gas and Water Stocks and Shares under Parliamentary Powers.
Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. Alfred Richards's Offices, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
PLYMOUTH AND STONEHOUSE GASLIGHT AND COKE COMPANY.

NEW ISSUE OF CAPITAL.

MR. ALFRED RICHARDS will Sell BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on
TUESDAY, the 10th of OCTOBER, 1899,
at Two o'clock precisely, in Lots,
£5000 OF ORDINARY STOCK
OF THE
PLYMOUTH AND STONEHOUSE GASLIGHT AND COKE COMPANY,
ranking for a Standard Dividend of 5 per cent., subject to the Sliding-Scale; the last Dividend having been 6½ per cent.
Particulars of the SECRETARY of the Company, at the Offices, PLYMOUTH; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TOTTENHAM AND EDMONTON GASLIGHT AND COKE COMPANY.

MR. ALFRED RICHARDS will include in the above Sale
£950 "A" STOCK, and
£600 "B" STOCK
in the above Undertaking, and upon which the last Dividends paid were 6 and 4½ per cent. respectively.
Particulars of the AUCTIONEER as above.

Re Mrs. Louisa Baynes, deceased.

REIGATE GAS COMPANY, SUTTON GAS COMPANY, AND NEWHAVEN GAS COMPANY.

MR. ALFRED RICHARDS will include in the above Sale—
£290 STOCK in the REIGATE GAS COMPANY.
80 £10 SHARES and £100 FOUR PER CENT. DEBENTURE in the SUTTON GAS COMPANY, and
74 £10 SHARES in the NEWHAVEN GAS COMPANY.
Particulars of the AUCTIONEER as above.

NORTH MIDDLESEX GAS COMPANY.

Ninety £10 FULLY-PAID SHARES to be sold by Auction, by

MR. ALFRED RICHARDS on the above date.
Particulars of the AUCTIONEER, as above.

SOUTHEND WATER-WORKS COMPANY.
NEW ISSUE OF £9000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

CATERHAM AND DISTRICT GASLIGHT AND COKE COMPANY.
ISSUE OF 250 £10 FIVE PER CENT. PREFERENCE SHARES.

ALDERSHOT GAS AND WATER COMPANY.
NEW ISSUE OF 130 £10 FIVE PER CENT. PREFERENCE SHARES.

MR. ALFRED RICHARDS has received instructions from the Directors of the respective Companies to SELL the above STOCKS and SHARES by Auction at the Mart, E.C., on Tuesday, Oct. 17, at Two o'clock, in Lots.
Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

IMPORTANT SALE OF GAS SHARES.

THE Directors of the Eastbourne Gas Company have instructed
Messrs. EASTER & WRIGHT
to Sell by Auction at Mr. J. C. Towner's Auction Mart, Eastbourne, on Monday, the 16th of October, 1899, at Three o'clock precisely, 1200 NEW "B" SHARES at £10 each in 240 Lots. The sale is made under the provisions of the Company's Special Act.
Particulars and Conditions of Sale may be obtained of the undersigned or of the Auctioneers, Eastbourne.
J. H. CAMPION COLES,
Secretary and Solicitor to the Company.
Eastbourne.

Crown 4to., Price 3s. 6d.

GASHOLDER AND TANK

(Of One Million Cubic Feet Capacity)
AT THE
SUTTON GAS-WORKS.
Designed and carried out by
F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E.
MEMBER OF THE INSTITUTION OF GAS ENGINEERS,
MEMBER OF THE SOCIETY OF ARTS,
CONSULTING ENGINEER.

EMBRACING NOTES ON GASHOLDER CONSTRUCTION GENERALLY.

REPRINT OF A SERIES OF ARTICLES IN THE "JOURNAL OF GAS LIGHTING," &c., WITH THE ACCOMPANYING PLATES.

PUBLISHED BY
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

NITRATE of Thorium and Cerium. FABRIK CHEMISCHER PRAEPARATE VON STHAMER, NOACK, AND CO., HAMBURG.

ENRICH YOUR GAS
WITH CHEAP
BENZOL
SPECIALLY PREPARED, FREE FROM SULPHUR.

AT to-day's Price of Benzol, Illuminating POWER costs less than ONE-THIRD OF A PENNY PER CANDLE.
Apply to SADLER & CO., MIDDLESBROUGH.

JAMES OAKES & CO.

ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per Ton. .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.
Telegraphic Address: "PARKINSON, NEWCASTLE."

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

WELDON MUD
FOR
GAS PURIFICATION.
For use in the
RECOVERY OF SULPHUR,
ALSO
Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:
GAS DESULPHURIZATION CO.,
— LIMITED. —
1, FENCHURCH AVENUE, LONDON, E.C.

HOLMSIDE
GAS COALS.
Present Daily Produce over 5000 Tons.
Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power 16$\frac{7}{10}$ Stand. Sperm. Candl.
Coke (of good & pure quality) 13$\frac{3}{4}$ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR
PELTON GAS COALS.
Present Daily Produce available 3000 Tons.
Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.
Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.
These Coals may be bought through the Principal Merchants in England, or direct from
MR. MARK ARCHER,
HOLMSIDE & SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
Telegrams: "DARWINIAN, MANCHESTER." Telephone 1806.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL Co., Ld
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
LONDON OFFICE:
90, CANNON STREET, E.C.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH N.B.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
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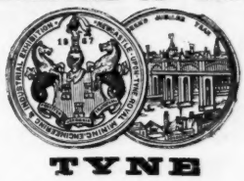

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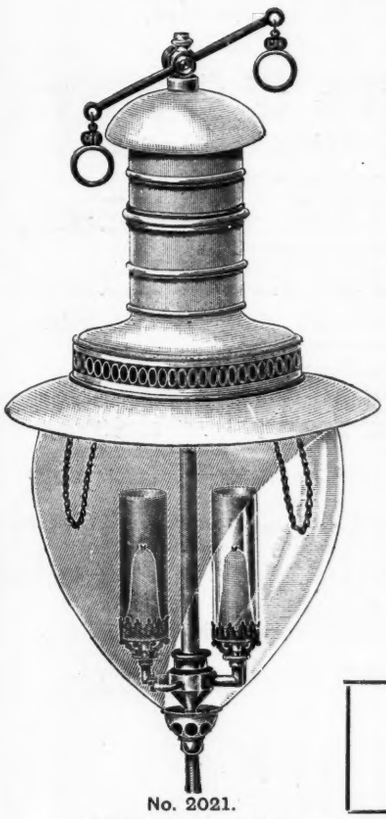

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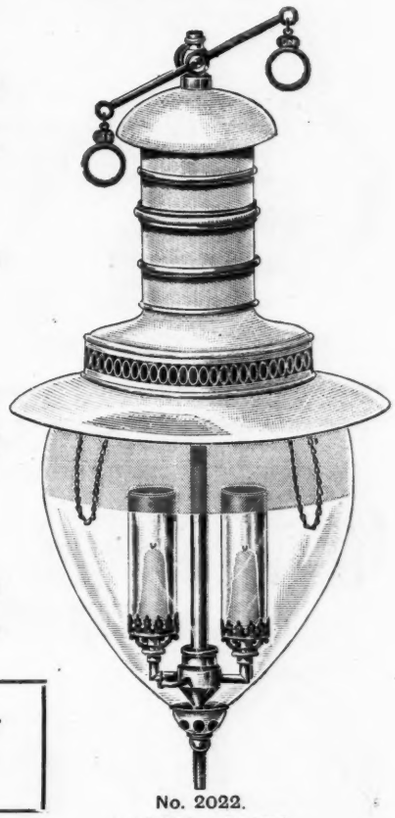

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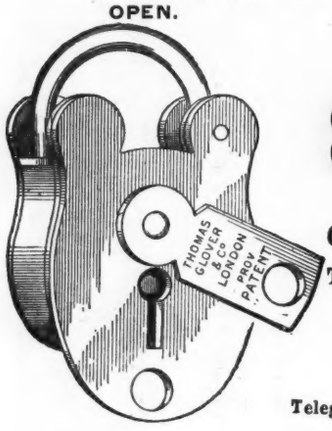

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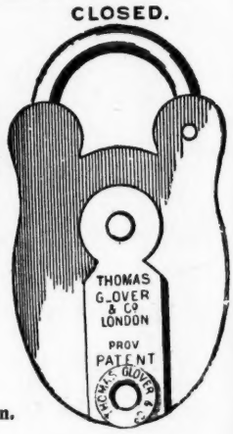

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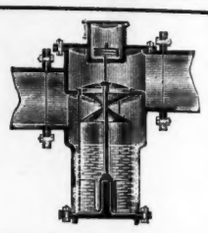

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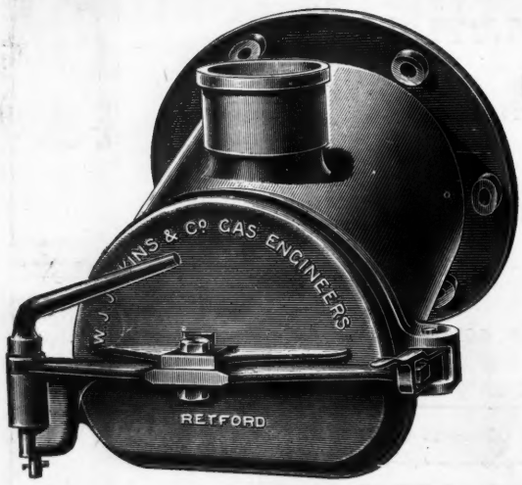

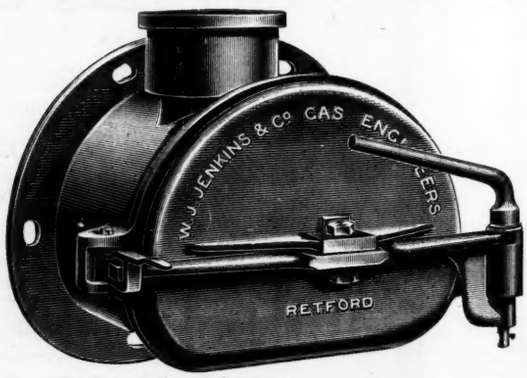

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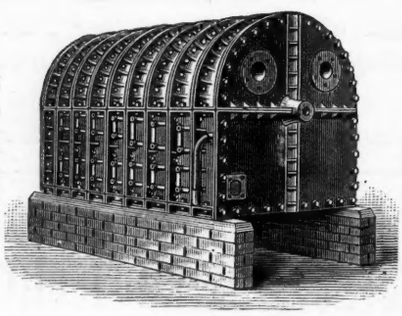
RAPHAEL HERRING, Engineer.



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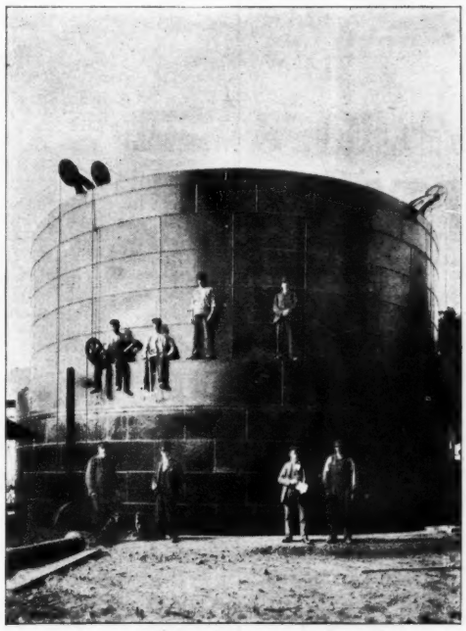

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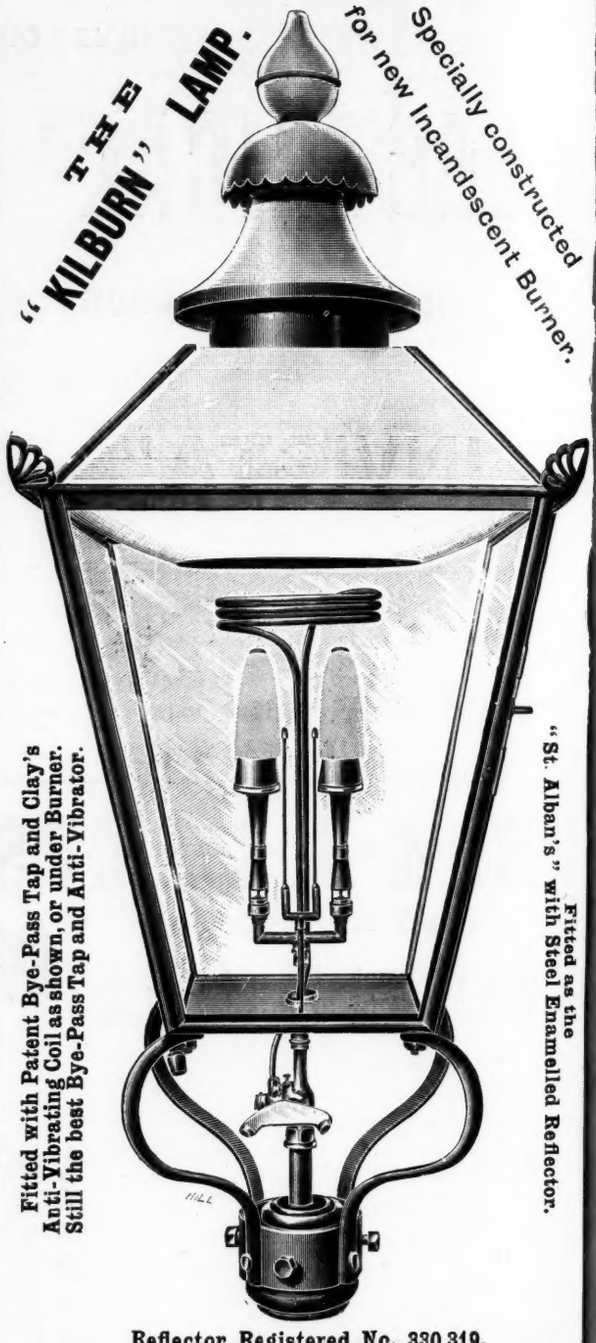

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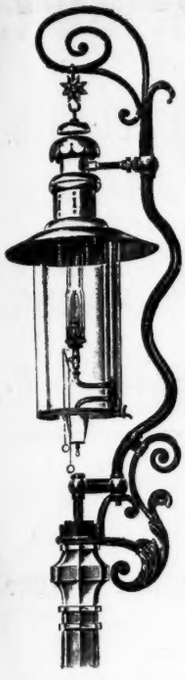

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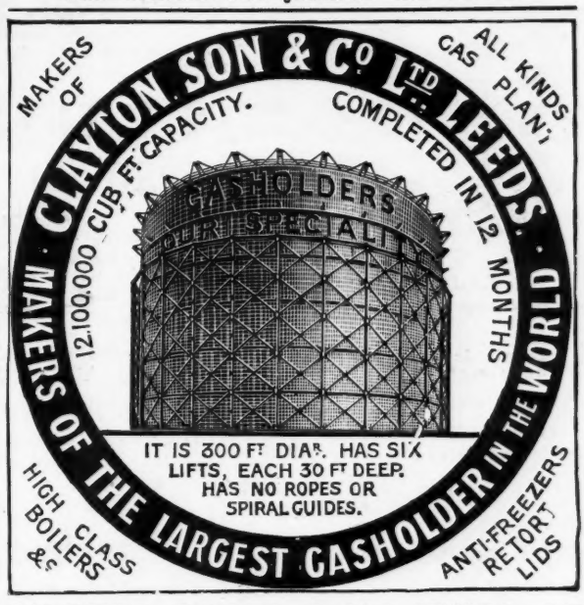
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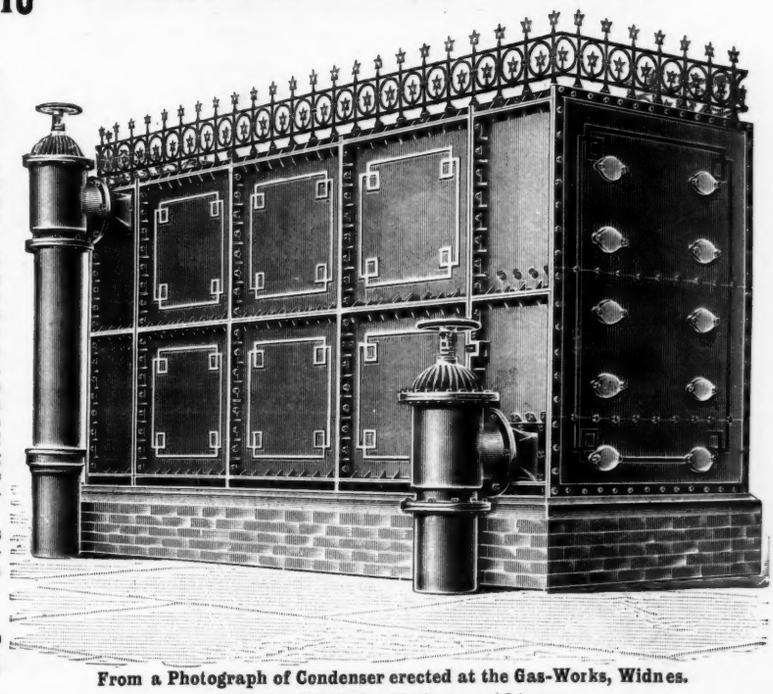
R. & J. DEMPSTER, LTD., recommend this Condenser to be used as a Finishing Condenser, after the gas has already passed through the ordinary Annular or Air Condensers.

Condensers of this type equal to 10,500,000 cubic feet per 24 hours already erected and at work.



From a Photograph of Condenser erected at the Gas-Works, Widnes.
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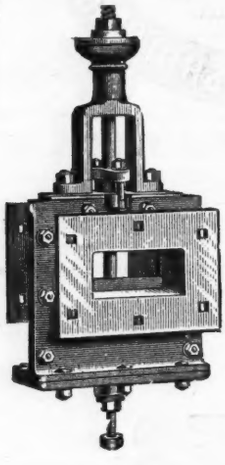

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